EDITORIAL

SILENCERS for Diesel engines have been developed by Mr. Hiram Maxim. They are based on the same general principle as the Maxim silencer for rifles. This will eliminate the principle objection to the use of Diesel-engine drive on passenger-ships. Several ships have already been fitted with these silencers.

THE Central Trades and Labor Council of Reno, which includes all labor organizations of Reno and Sparks, has announced that it will concentrate further efforts on reduction of living costs, rather than on increase of wages. The Council further states its opinion that the merry-go-round of higher wages, higher living costs, etc., is of no benefit to its members. If the Council will reason a step further and realize that increased production must precede any material reduction in living costs, it will really get somewhere.

THE proverb that if you keep a thing long enough you will find a use for it seems likely to be exemplified again in the cement-plant owned by the city of Los Angeles. It will be remembered that the city built an aqueduct a few years ago, also a cement-plant to make cement to build the aqueduct. After the aqueduct was finished the city tried to sell the plant, but, unfortunately, nobody seemed to want to bite, and the plant has been idle for most of the past seven years. Now comes a syndicate of men with real money, who say that, while the outfit is not worth a whoop for making cement, they believe it will make a real nice potash-factory, and that, if it does, they will buy it. This little incident gives us reason to hope that somebody may yet find a use for the concrete shipyard over in the Estuary.

SEATTLE'S primary election eliminated the incumbent, Mr. C. B. Fitzgerald from the finals. Mr. H. M. Caldwell led, and Mr. James Duncan, secretary of the Seattle Central Labor Council was a close second. What makes the contest of special interest outside of Seattle itself is the fact that Mr. Duncan was one of the leaders in the general strike there a year ago, and also had his finger in the general strike at Winnipeg a few months later. That he should have the nerve to run for mayor now is surprising. That he should have received a third of the 75,000 votes cast in the primary is both surprising and disquieting. Mr. Fitzgerald succeeded to the mantle of Mr. Ole Hanson when the latter resigned. Mr. Caldwell is a former district attorney, has a war record, and made his campaign mainly on attacking the Fitzgerald administration. Apparently, however, he has no I. W. W. or Bolshevik leanings. Besides Mr. Duncan, most of the candidates for the council nominated by the Bolshevik element qualified for the final election, which takes place on March 2.

AUSTRIA is admittedly in a bad way, but there is something unusual about the most recent request for American assistance that has come from that troubled country. They are not asking for capital this time, although heaven knows they need it badly enough. Instead they have come to the conclusion that their worst trouble is lack of wise management. So they suggest that a syndicate of American business men be formed to take over and run the mines and public utilities of the country. Gone are the days when German efficiency strutted before the world, when Austrian technical schools were famous. They want a little plain American common sense and management. It may seem as if we had none to spare, particularly the former commodity, but let us hope we can arrange it. They certainly need it over there.

MR. GLENN E. PLUMB, originator of the Plumb plan for establishing a soviet to run the railroads, is loose again. Apparently neither his railroad scheme nor his proposed extension of the same idea to the administration of all industry have yielded him all the notoriety he craves, so he now comes forward in a speech before the 'All-American Farmer-Labor-Co-Operative Conference', whatever that may be, with a proposal to discharge the national debt by a levy upon capital. During the ages, this method of killing the goose that laid the golden egg has been proposed many times. However, it has, fortunately, seldom been tried, but, when tried, has always ended in disaster. When taxes reach a certain figure, which must, at least, be less than income, confiscation, actual or virtual, must follow. And after confiscation there is nothing left to tax.

ATTENTION of our readers is called to the article by Mr. John F. Johnston on 'Seventy Years of Organized Labor in San Francisco'. Mr. Johnston has very properly treated his subject from the standpoint of the impartial historian, which was probably the reason why he refrained from commenting on one feature of the chart accompanying the article. Study of this chart shows that 'hard times' (which bear as hard or harder upon the wage-earner as upon the employer), have been preceded by 'peaks' in the curve of union membership, and that periods of prosperity usually follow a time when the membership in labor unions is at a low ebb. These sequences happen so often that we can hardly consider them merely coincidences. It ought to be possible to have labor organizations that would cause prosperity, not hard times. Let us hope that some day this will come to pass.

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The Low Cost of Flying

In these days of rising prices it is a pleasure to learn from a statement recently issued from the Post-Office Department that since the aeroplane service was started, the Department's machines have covered 473,210 miles at a cost of 84 cents per mile. The industry is so young that no comparable figures are available, but the cost seems quite reasonable, particularly in view of the further statement that, allowing for car-space saved, the service has paid for itself. Over twenty-two million letters were carried, and it is estimated that the average advance in delivery time as compared with ordinary methods of transportation, was 16 hours. Perhaps the most valuable result of this, the most important pioneer attempt in the field of commercial aviation, has been the demonstration that flying in any kind of weather is practicable.

When Will They Demobilize

We have received a communication from the United States Civil Service Commission announcing that the Government is in need of a large number of draftsmen. Fully 1000 draftsmen were appointed in the various branches of the Government service during 1919. Besides draftsmen there are openings for surveyors and computers, also assistant engineers, electrical, mechanical, civil, chemical, and ceramic. We are glad to give this announcement the publicity requested, since, if there are jobs open, we want our readers to know of it. But we would like to ask when is the demobilization of our civilian forces going to commence? It is 16 months since the Armistice, the Army has gone home long ago, but so far from there being any break in the civilian ranks at Washington, this new call for recruits has been sounded. We have no desire to reflect upon the Civil Service Commission, which we presume, is as powerless in the matter as we are, but we do earnestly wish that some of the other Government departments, including the United States Senate, would realize that the War is over.

The Shipyard Strike

There has been little change in the strike situation in the San Francisco Bay district. All the shipyards and nearly all the commercial shops are operating, and are increasing their forces, although it is probable that few, if any, of the firms have all the men they could use in all the trades. Some of the strikers have gone back to their old jobs, some have obtained jobs either in the shops that surrendered to the unions or elsewhere in the district, and many have left the district entirely. This movement away from the district is being encouraged by the labor leaders with the avowed intention, if they cannot win the strike, of crippling the metal industries by reducing the supply of available labor. The various injunctions against picketing obtained by the shipyards, including the one recently granted at the petition of Moore Shipbuilding Company, have had a salutary effect in reducing violence and intimidation, but there is still considerable trouble on this score. Probably the worst difficulties now are experienced not by the shipyards, but by the smaller shops, where the men go home from work singly or in small groups and where police protection is seldom available. The tentative works-council plan described in our last issue has been placed in effect at the shipyards and at most of the larger commercial shops, and, while it is too early to form any definite conclusions, the results so far have been satisfactory to both workmen and employers. In view of this fact, as well as the further fact that most of the firms appear to be working at near enough to capacity to make their operations profitable, there seems to be little chance for the unions to win the strike, and the outlook for freeing the metal industries from union domination is favorable.

Wanted—A State Constabulary

The violence and disorder accompanying the shipyard strike as well as the Oakland car strike last fall have served to emphasize both the inability of local police forces to cope with such outbreaks and the need of a State constabulary to handle this and similar situations. While it is probably true that in this as in other strikes accompanied by violence, a large part of the trouble is caused by non-strikers and is deprecated by the strikers themselves, the fact remains that such violence occurs, and that arrests by local police are few, and convictions fewer yet. It may be that the police departments are doing their best. If they are, it merely indicates that they need help. In States maintaining a constabulary, worse situations have been handled with less violence. Under ordinary conditions, the better acquainted a peace officer is with the people of his district, the better officer he is. If, for instance, in the dear dead days before July 1, 1919, he saw John Smith carrying too heavy a 'package' and knew that John was a reputable citizen 364 days out of the year, and also knew that once he was home and quiet no further trouble would occur, he probably persuaded John to go home and saved the 'People' an unnecessary arrest and John and his family from a certain amount of disgrace. When, however, feeling runs high in a community and real disorder occurs, the conditions are different. Here is where the advantage of Federal troops or a State constabulary lies. It is not so much in the additional numbers as it is in the knowledge on the part of the mob or of individuals that these men see no friends in the crowd that they would like to spare, no enemies that might wield political influence to get them 'fired', but that their only interest is the preservation of order and the protection of life and property. Not only for strike duty but for similar emergencies do we need a State constabulary in California. Let us try to get one at the next session of the legislature.

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Tell Them About It

Authorities agree that an important cause of industrial unrest is the belief on the part of the employee that the boss is putting something over on him, and more particularly that he, the boss, is making large profits from the product of the employee's labor. That this belief is so prevalent is not at all surprising when we consider that few employers make an effort to tell their workers anything about the business in which they are mutually interested. With no opportunity to learn the truth, the employee naturally believes whatever lie happens to be told to him in the loudest tone of voice. When, after this sort of thing has been going on for years, the employer, in response to a demand for an increase of wages, issues a statement that he cannot pay the amount, and that he made only 4% on his money the year preceding, he wonders why it is not believed immediately. More information regarding every phase of the business made available to the employee would be of advantage in any plant. Surely it would not diminish a machinist's interest in his work to know that the particular job is destined to go, let us say to India, and that the company got the contract largely because of its established reputation for furnishing the best equipment. It does not matter much whether this information comes to him by word of mouth, through the house-organ, through the bulletin-board, or what not, as long as it comes, and 'gets across'. Too many shop bulletin-boards display an announcement of a change of superintendent, dated May 1919, a communication from the War or the Navy Department, dated August 6, 1918, and two or three bulletins from the National Safety Council, very good in their way but sorely in need of dusting. Why not make the bulletin-board work a little harder?

Government Ownership

Mr. Leslie M. Shaw, former Secretary of the Treasury, whose experience certainly entitles him to speak with authority concerning governmental activities, has written some interesting reminiscences in support of his contention that excursions by the Government into business are necessarily accompanied by inefficiency. One of the incidents which he cites is the following:

"During the Indian insurrection in Texas a certain officer got word to his quartermaster that he must have supplies and ammunition at a given point on the Rio Grande river without delay or his detachment would be annihilated. . . . Rather than fail, the quartermaster purchased a boat for $12,000. He loaded it with supplies and ammunition, started up the river and made his report. Promptly the government at Washington refused to ratify the purchase and reprimanded the quartermaster severely for exceeding his authority in purchasing the boat. I submit that the department was right. No member of Congress would vote to give a quartermaster authority to buy a river-steamer. Even the Secretary of the Navy would need Congressional authorization.

"Fortunately, the boat returned and the quartermaster tried to get the man to take it back. He refused. Then the quartermaster found a purchaser, sold the boat for $12,500, paid the purchase price, and sent $500 to Washington. Promptly the department refused to ratify the sale and again reprimanded the quartermaster because he had sold the boat without authority. And the department again was right. Congress has never given and never will give authority to a quartermaster or anyone to sell a boat or anything else except after prolonged condemnation proceedings, and then at auction. Any corporation, under like circumstances, would have made the quartermaster a vice-president. Instead, his pay was held up and he faced court-martial until some comptroller risked his official life and reputation by closing the account, also in violation of the law."

And yet there are people who would have the Government extend its business activities.

Uniform Freight Rates

A recent decision by the Interstate Commerce Commission in what appeared to be a relatively unimportant case enunciated a principle that is likely to be of great importance in fostering Pacific Coast industries. The Portland Rubber Mills complained that the Oregon-Washington Railroad & Navigation Company was charging it a freight-rate on rubber soles and heels shipped east 50% higher than manufacturers of the same class of goods were paying on westbound shipments. The Commission decided in favor of the rubber company, and refused to entertain the contention of the railroad that, since the volume of westbound was heavier than the volume of eastbound freight, the westbound traffic was entitled to a lower rate, since this would perpetuate the disparity between freight movements.

Ethics—Business and Professional

Our readers will remember the Biblical story of Esau, eldest son of Isaac, the blind but wealthy sheepman, who sold his birthright to his younger and craftier brother Jacob, and how with the connivance of Rebecca, the boys' mother, Isaac was tricked into approval of the transaction. Probably Esau, after he had come to full comprehension of the import of the deal remarked, "Business standards are certainly very low in this part of the country. As a professional man I could not think of doing such a thing." Jacob continued in the stock business and had many interesting adventures. The Biblical account is not so specific regarding Esau, but we are inclined to believe that he opened offices as a consulting engineer.

Since that memorable day on the Syrian plain, the paths of the sons of Esau and the sons of Jacob have crossed and re-crossed many times, but always there has been this feeling that a different standard of ethics must prevail in business than in professional life. And both

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business and professional men have suffered in consequence. Business men as a whole have suffered because some of their number, given a bad name at the beginning, decided that they might as well live up to it, and descended to sharp practices in which they would not have indulged had the world shown it expected something different. Professional men have suffered mainly in the ways that any group of men must suffer when it withdraws itself from the world of common men and sets itself upon a self-erected pedestal. Monasticism may be all right in its way, but it has no place in the life of the present-day professional man.

Nearly two thousand years ago, not far from where Jacob and Esau parted, one of Jacob's descendants gave utterance to various rules for success in business, rules that have never been improved upon. Among the most important of these was "He that would be greatest among you, let him serve." What, after all, is the main thing that either the professional or the business man sells, or, rather, has to offer in return for his living? Service. Is there any essential difference in the quality of the service rendered by the engineer that designs a plant and passes upon the final selection of the machinery and the service rendered by the manufacturer that furnishes the machinery, erects it, and not only stands back of it in case anything goes wrong, but also shows the owner how to operate it so that things will go right? Need there be any essential difference between their respective standards of ethics? Of course, the manufacturer ought not to attempt to furnish the service rendered by the engineer, for that, among other things, usually implies passing upon the comparative merits of his own and other firms' machinery.

Let us forget about these fancy standards of ethics and come down to earth, the Golden Rule, and the ideal of Service. Service is the main thing we can give, and this is a secret—it in itself is also the principal reward in life.

Return of the Railroads

At this writing, the compromise measure dealing with the status of railroads has not yet passed Congress, but it is reasonable to suppose that such action will be taken before March 1, the date set for their return to private hands. The details of the bill in its final form have not been finally determined, but in general it provides for a guaranteed minimum return for a limited period, for a fixed maximum return for an unlimited period, for the creation of a new commission to deal with certain features of railroad regulation, and, in place of the anti-strike section of the Cummins bill, for a rather complicated system for arbitrating labor disputes.

It is unfortunate, for two reasons, that the principal thought in the minds of so many people in connection with the return of the railroads is 'Now we will have improved passenger-service'. One reason is that the deterioration of passenger-service that has taken place is relatively unimportant, and the other is that any appreciable immediate improvement is not to be expected, or, if it comes, can come only at the sacrifice of other more important improvements. Nine out of ten of the inhabitants of these United States travel so little that, while they may have been annoyed at the shortcomings of the past two years, they have hardly been even inconvenienced. The tenth man, we admit, has a kick coming, but being unable to get 'a lower out of Chicago', while unpleasant, is hardly a deciding argument in the case against public ownership. Furthermore, these petty annoyances were mainly the result either of deteriorated and inadequate equipment or of lowered morale among railroad employees, neither of which can be restored in a day or a month, even with the most efficient of management.

The real breakdown of railroad service has been in the freight department, and here the Railroad Administration is only partly to blame. The past policy on the part of public-service commissions of throttling the railroads, the War itself, and, more recently, the coal strike, have all had their share in making the term 'freight deliveries' a by-word. Any considerable change in this respect must come from an increase of both rolling-stock and other facilities, and that is a matter of time and improved railroad credit.

This question of credit is perhaps the most important of all. Unfortunately, Congress seems to have been far more interested in keeping the railroads from making too much money, than in making it possible for them to earn enough to permit them to borrow more. Billions must be obtained during the next few years. To attract this capital, what is Congress going to offer? A sure 5½% for six months and a good chance of getting that amount thereafter, with a reasonable certainty of never getting more than 6%. Frankly, we do not believe that this will be enough to attract the investor, nor will the prospect of being obliged to share a large part of their excess returns with the 'weak' roads, encourage the officials of the 'strong' roads to sit up nights devising methods of improving the service and of effecting economies. In fact, the attitude of Congress on this question is merely another of the long list of examples of the present desire to penalize the ant in favor of the grasshopper.

In spite of the thunderings—and vaporings—against the anti-strike provisions of the Cummins bill, we are sorry that they were eliminated in the conference measure. The strike as a means of settling labor disputes is antiquated, and it is as much to the interests of Labor as either Capital or the Public that it be eliminated. The Cummins bill would have been a step in that direction. Let us hope that the substitute provisions will also prove to be such a step.

On the whole, the outlook is not encouraging. However, the railroads are going back to private ownership, and nearly all of us are glad, including many who were advocates of public ownership two years ago. Let us hope for the best. At any rate, we can always walk.

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Machining Crank-Cases for 'Caterpillar' Tractors

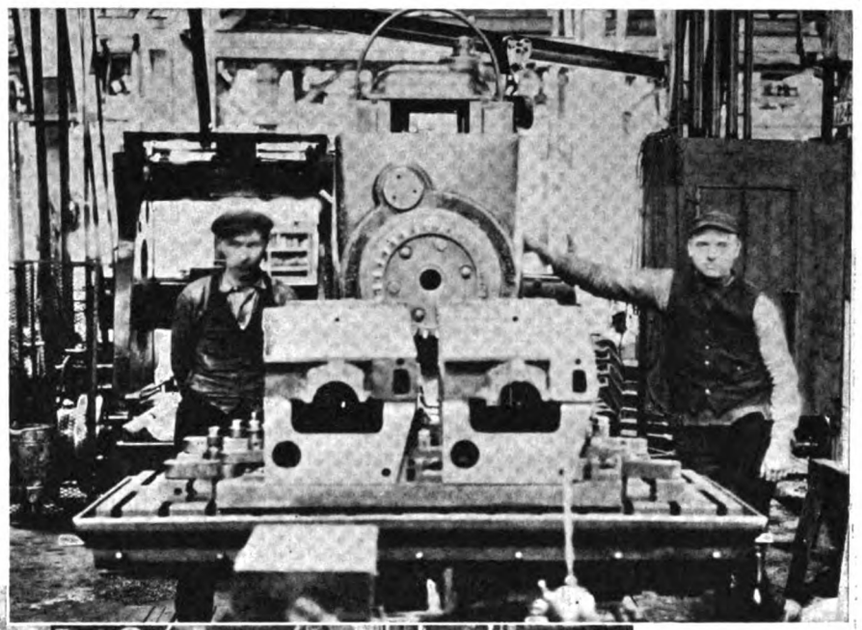
It is generally conceded that the modern tractor is called upon to withstand as hard or harder usage than any other type of machine. Such service demands the best of both materials and workmanship, and yet at the same time, the machine must be sold at a price that the user can afford to pay. To fulfil these conditions and at the same time to remain solvent, a manufacturer must study every process throughout his plant in order to secure the maximum economy of operations. The present article deals with the machining of crank-cases for the 'Caterpillar' tractor at the plant of the Holt Manufacturing Co. at Stockton.

Fig. 1 shows the crank-cases just after they have been received from the foundry and set up on a Cincinnati planer. They weigh approximately 950 lb. each. A roughing and a finishing cut are taken at the same setting. Formerly two crank-cases were machined at one time, while now, as shown in the photograph, six are set up, making a saving of practically two-thirds on the time for this operation.

The next two operations, namely, side-milling and end-milling, are similar in character. Both operations are done on Niles-Bement-Pond milling machines. For the side-milling a fixture is used accommodating two cases, and while one case is being machined the operator sets up the other case. Both sides of the case are finished at one set-up. The end-milling operation is shown in Fig. 2, the two cases being milled at the same time. When one end has been milled, the fixture is simply turned around, and the work repeated on the other end.

Fig. 3 shows the boring and reaming operation for both crank-shaft and cam-shaft bearings. The maximum variation between any of the holes in the same lines does not exceed 0.002 in. The machine used is practically a 'home-made' affair, built especially for the work. Part of the frame of the original horizontal boring-mill remains, but gears, length of bed, etc., have all been changed and new fixtures designed especially for holding the work.

Fig. 4 and 5 show the last two operations, namely, drilling and reaming both ends and sides. Fig. 4 shows the set-up on a Bickford drill for the ends, and the jig in place for determining the position of the holes. When one end is finished, the case is turned over and the operation repeated. There are 13 holes in each end, of different sizes. Fig. 5 illustrates the similar operation on a Cincinnati Bickford machine for the side



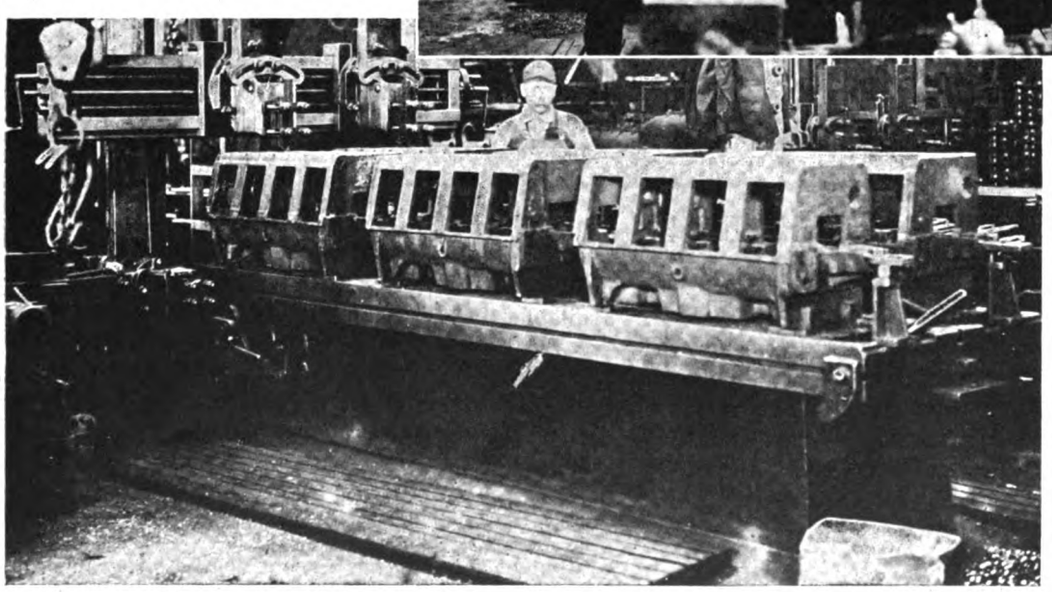


FIG. 1. (BELOW) PLANING SIX CRANK-CASES AT ONE SETTING. FIG. 2. (ABOVE) END-MILLING CRANK-CASES.

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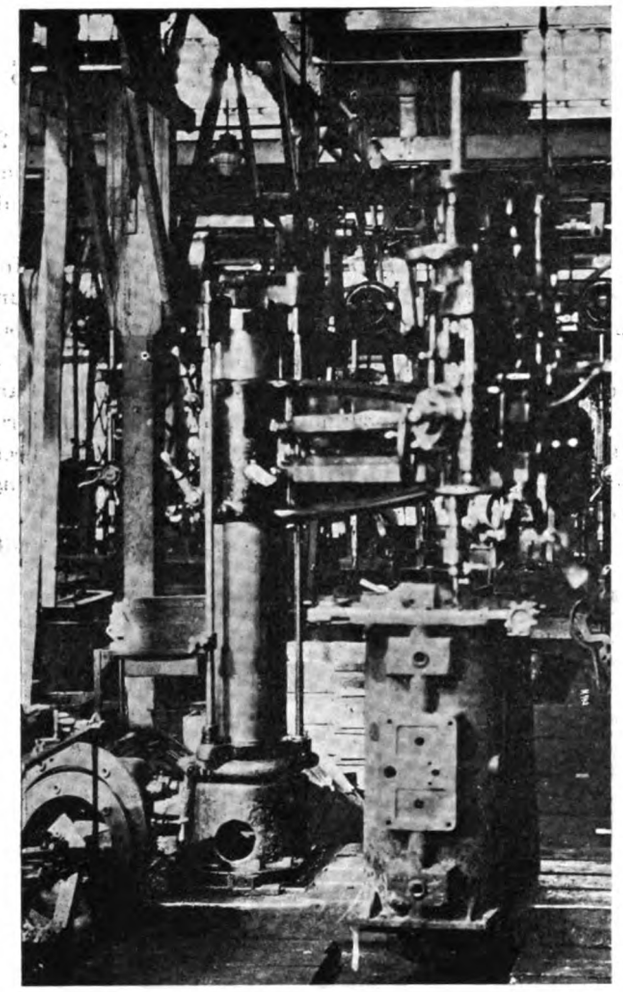

FIG. 4. DRILLING END OF CRANK-CASE

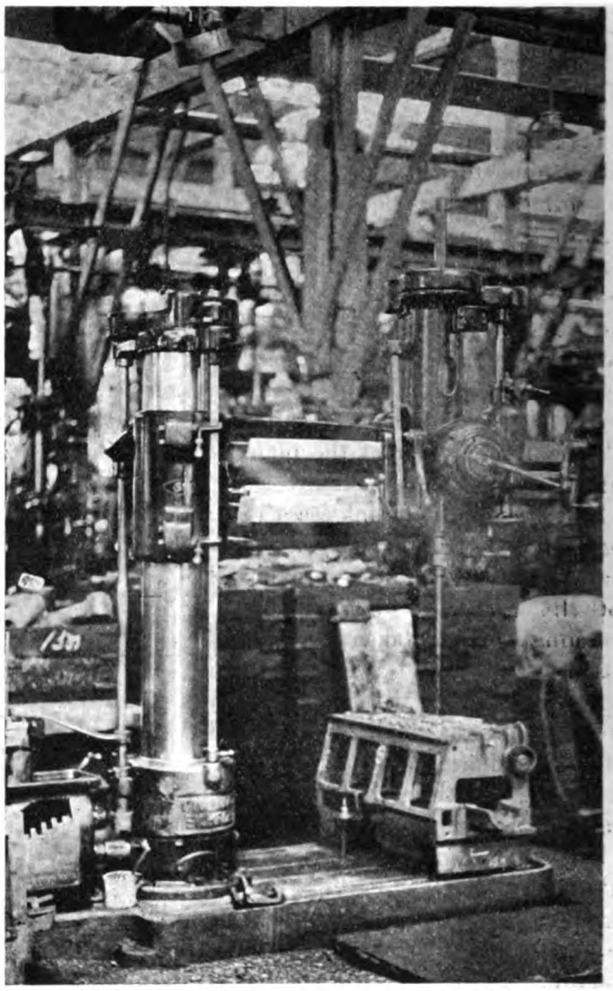

FIG. 5. DRILLING SIDE OF CRANK-CASE

of the case. There are 50 holes in each side.

The output for each operation is as follows:

Planing crank-case tops, 30 per day.

Planing bottoms, 50 per day.

End-milling, 5 per day.

Side-milling, 8 per day.

Boring and reaming crank-shaft and cam-shaft bearing, 8 per day.

Drilling and reaming ends, 8 per day.

Drilling side, 12 per day.

The milling surface on top and sides is 3 ft. and at the ends, 12½ inches.

Acknowledgement should be made to D. B. Ellsworth, superintendent, and A. G. Lillybridge, assistant superintendent of the machine-shop department of the Holt Manufacturing Co. for help in preparing this article.

Industrial Relations Department Established by Los Angeles Association

In his annual report recently made public, I. H. Rice, president of the Merchants' and Manufacturers' Association of Los Angeles, announced the formation by the Association of an industrial relations department under the direction of C. A. Fultz. The scope of this department is tentatively described as follows:

1. To establish a competent industrial relations council, which will be thoroughly representative of the employers of Los Angeles.

2. Through this council to set up an effective clearing house of industrial relations information.

3. To make a thorough survey of industrial relations, working conditions, and general terms of employment in Los Angeles.

4. To gather from employers, employees, and all other available sources, data covering the subject.

5. To establish a bureau of information covering various phases of industrial relations and including a library of literature upon the subject.

6. To publish and distribute, as occasion may arise, bulletins covering interesting developments and helpful plans in the field of industrial relations.

7. In short, this department will seek to supply the equipment for carrying on constructive programs in matters of industrial relations. Its object will be to try to help in solving one of the most vital problems of the day in a practical, common-sense, and business-like way.

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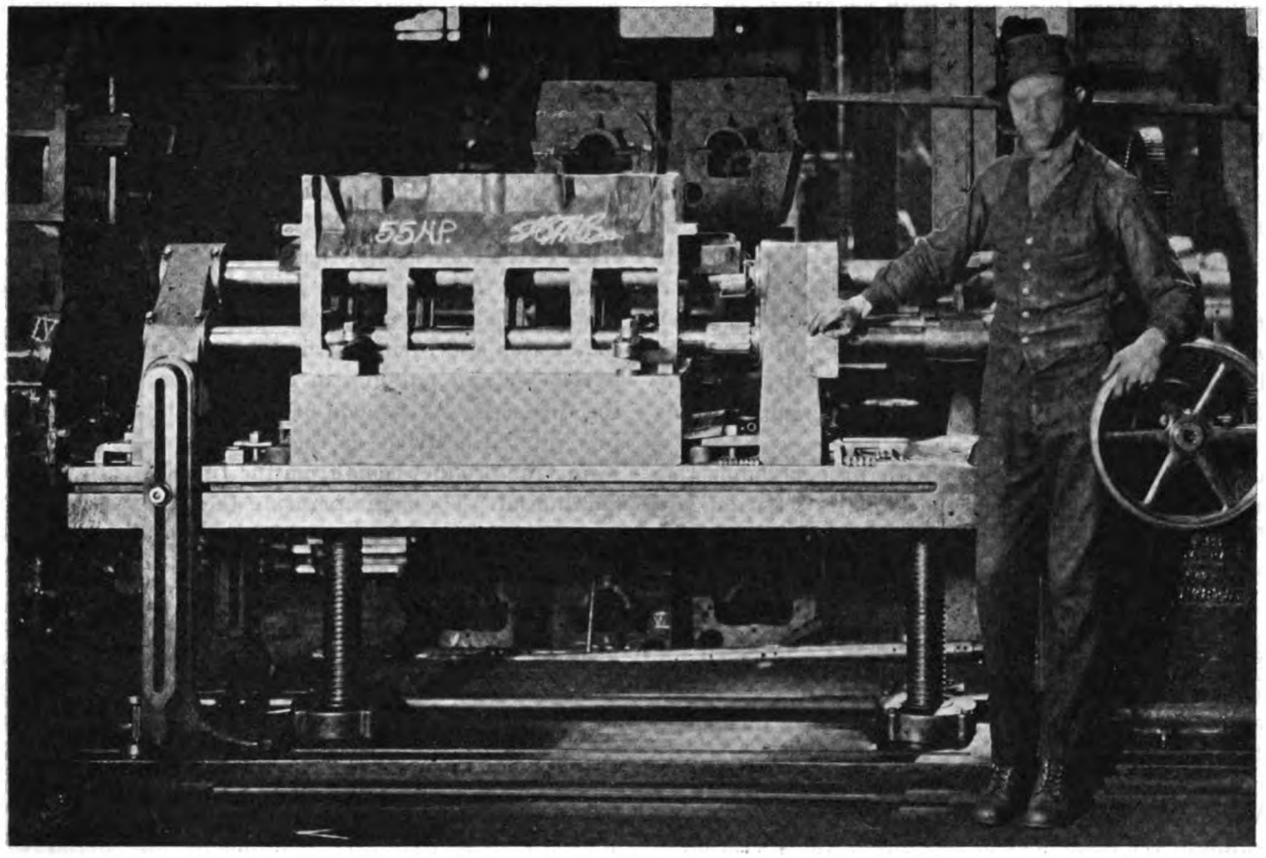

FIG. 3. BORING AND REAMING CRANK-SHAFT AND CAM-SHAFT-BEARING

Fuel Costs as Affected by the Design and Operation of Furnaces

In a paper presented at the convention of the American Steel Treaters' Society, Claud S. Gordon, metallurgical engineer, of Chicago, stated that the heat of combustion in a metallurgical furnace is dissipated in three ways, namely, heat absorbed by the stock to be heated, heat radiated by the furnace, and heat carried off by waste gases from the furnace. In the ordinary gas or oil-fired furnace, the division will be about 46% by waste gases, 40% by radiation, and 14% utilized in heating the product. In coal-fired furnaces the loss is even greater, since there is a small loss through the ash. These losses may often be reduced by using the waste gases for pre-heating air, and by the proper insulation of the furnace.

Some furnace manufacturers are utilizing a large part of the waste gases in pre-heating air for gasifying or vaporizing the oil before it enters the combustion-chamber. In this case the air for combustion is pre-heated to about 800°F. and passes through a regenerative apparatus where it heats the oil to a gasifying temperature. With this method there is still considerable loss because the temperature of the waste gases for heating the pre-heater must be above the temperature of the pre-heated air, or it must be at least 1100°F. to pre-heat the air to 800°F. Other manufacturers have placed a pre-heating chamber above their furnaces where the air for combustion is pre-heated to 400 or 500°F. They not only furnish this equipment for oil-fired furnaces, but also for gas-fired furnaces.

Consumers have been found utilizing the waste heat from their furnaces in many unique and practical ways. For instance, a few concerns have core-ovens built either above or adjacent to annealing or heat-treating furnaces and the waste gases are used to supply heat for baking cores. The owners of one large foundry stated that they were obtaining sufficient heat from their waste gases to bake all the cores required in their foundry work. Another concern has waste-heat boilers installed in connection with all of its forge-furnaces and it is not only utilizing the waste gases but has water-tubes passing through the walls and roofs of the furnaces which reduce the radiation losses and helps to keep the walls and roof from burning out. From these waste-heat boilers it obtains sufficient power to operate a number of its steam-hammers. Another manufacturer is utilizing the waste gases from a forge-furnace and heat-treating furnace for

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annealing the glass lenses used with headlights on automobiles. Another concern is using the waste gases from its forge-furnaces for heating a small boiler, which operates a turbine-blower for furnishing combustion-air.

When the waste gases are utilized advantageously it is not so important to reduce the temperature of these gases. But it is important that complete combustion be obtained before these gases leave the furnace; but on the other hand mistakes may be made by getting complete combustion too quickly after the fuel leaves the burner. This may be done by an excess of air for combustion being forced through the burner, which will cause the fuel consumption to increase rapidly without a temperature-rise in the furnace. It will also cause scaling of any stock that is being treated in the furnace.

A furnace that is operating with proper combustion at a certain temperature will consume a given amount of fuel. This temperature may be held constant by increasing the fuel consumption and then regulating the air, but an excess of air must be supplied to reduce to the required temperature. A temperature may be held constant in this way while the fuel consumption is increased 100%. With an excess of air the waste-gas temperatures may be much reduced, but the loss due to the heating of an excess of air is even greater than it is with a high waste-gas temperature.

When the users of furnaces come to a complete understanding of the economies to be made in the operation of a furnace by the proper ratio of fuel and air, furnaces will all be equipped with ratio apparatus so that the air and fuel will be regulated from the operation of one valve, in this way giving at all times the correct proportons of fuel and air. Such an apparatus will make a large saving.

In most installations at the present time the proper regulation of fuel and air is left to the furnace-operator entirely and he is unfamiliar with the details of combustion. He has no means of determining the proportions except by the color of the waste gases coming from his furnace or by the flame inside of the furnace. The flame is deceiving, due to the fact that it may be affected by impurities in the fuel or atmospheric conditions of the furnace or even by the construction of the furnace. In one instance, proper regulation reduced the gas consumption in nut-stamping furnaces from 15,400 to 7100 cu. ft. per ton of stock.

Losses due to radiation are hard to utilize but they may be reduced to a minimum by proper insulation. For instance, tests were made on a small electric furnace. This furnace had been on the market for several years and had been lined with a silica flour. The consumption was approximately 1 kw. A special furnace was built up utilizing the same heating-element but lined with a special infusorial earth. The two furnaces were brought to a temperature of 1800°F. and it was found that the one lined with infusorial earth reached that temperature in 60% of the time that it took to heat the furnace lined with silica flour. Upon further test it was found that the furnace lined with infusorial earth could be operated successfully on about 75% of the current consumption of the furnace lined with silica flour.

The pyrometer is utilized extensively for the heat-treating furnace, but not in the forge-plant. However, it will be only a short while before it will be recognized as a necessity in hammer-shops. In one large forge-plant in which the management was complaining of fuel costs, they were advised to install a pyrometer system, but because of the troubles they had had in the heat-treating department, they were not favorably inclined. Finally they decided to hire a good man who had some idea of combustion and furnish him with a portable quick-acting pyrometer and put him in the hammer-shop to operate the furnaces. At the end of the first day he had almost precipitated a strike, as the hammer-men were used to seeing the product come from the furnace with the oxide melting off. The man operating the fires was instructed to keep below a certain temperature. Production was cut about 25% the first two days, but the hammer-men became used to the lower temperature and, as they were on piece-work, they were soon working at a normal production, and with much lower furnace temperatures. Some time later this manufacturer stated that his new furnace-man had saved in cost of fuel alone many times the cost of the pyrometer and his wages, besides the better product coming from the hammer-shop.

In another plant they were having trouble with rejections. The pyrometer equipment was found to be correct, consequently the cause of rejection was not at this point. The plant, having a chemical laboratory, knew that the trouble was not in the analysis, therefore an investigation was started. In the press-forge shop two large oil-furnaces were used to supply stock to a large press-forge hammer. These furnaces were operated without regard to combustion or temperatures, the chief ideas being heat and production. Flames were shooting around the doors for four feet and out of the vents even further. The final decision was to install a pyrometer and oil-meters on these furnaces.

Oil-meters showed an excess of fuel consumption and the pyrometers showed an excess of temperatures. The pyrometer was installed one afternoon, and the next morning the thermo-couple was found burned off flush with the inner wall of the furnace. A man was then put on the job twenty-four hours per day to watch the temperature. Again production was cut and dissatisfaction was created among the hammer-men, but the proportion of rejections was lowered. The final result was a reduction of only 5% in production, a saving of 44% of fuel, and rejections were cut from 40% to less than 4%.

Combustion and waste of fuels in metallurgical furnaces have not been followed as they should. About the only items taken into consideration have been costs of fuel, and pounds or tons of work produced, without giving consideration to the details that enter into the comparison of these two items; but because of the variations in cost and quality of fuels at the present time, we are beginning to stop to consider these details more and more each day.

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Essentials of Correct Oil for Gas-Engine Cylinder Lubrication

THIS outline of the essentials of correct oil for gas-engine cylinder lubrication has been prepared by the board of lubricating engineers of the Standard Oil Co. for the purpose of giving automobile and truck operators a better understanding of the real requirements of correct cylinder lubrication. If this can be accomplished, it will result in correcting several erroneous impressions which are prevalent regarding this subject, and will be of assistance in securing more efficient and economical engine operation.

The correct lubrication of pistons and cylinders in automotive gas-engines presents problems that are not encountered in the lubrication of bearings in other forms of machinery. The lubricating-oil used for this purpose is required to fulfil several different functions under severe operating conditions and to meet these conditions successfully it must be especially adapted to the particular type of engine to be lubricated.

The first and most important duty of the lubricating-oil is to reduce friction between the surfaces of the pistons and cylinder-walls. This includes the friction of the piston-rings as they move with the piston. The area of the bearing-surface of the pistons as they slide up and down in the cylinders is comparatively large, larger in fact than the combined area of all other bearing-surfaces in the engine. For instance, the area of the bearing surface of a 4-in. piston is approximately 50. sq. in. If you multiply this by the number of pistons in the engine, it is obvious that there is a large surface to be lubricated. A continuous and unbroken film of oil must be maintained on every part of this entire surface so that there will be no actual metallic contact. While both pistons and cylinder-walls are generally ground to a smooth finish, this smoothness is only relative. Examination of the surfaces under the microscope show roughness and unevenness, and that the apparently smooth surfaces are really a series of small hills and valleys in the metal. Without lubrication, these depressions and projections would interlock, and the motion of the pistons would cut and abrade the metallic surfaces, producing excessive friction and rapid wear. The function of the lubricating-oil is to fill these depressions, forming a cushion that keeps the bearing-surfaces apart, and substituting the small amount of friction in the oil itself for the excessive friction of bearing-surfaces in actual contact.

A continuous and unbroken film of oil must be maintained on every part of the bearing-surface of the piston so that there will be no actual metallic contact.

In practically all automobile and truck engines, the oil is supplied to the cylinder-wall by splash or throw-off from the revolving crank-shaft. The lubricating system is designed to supply the correct amount of oil under varying conditions of operation, but the oil used must be of the proper body or consistence. If it is too light in body, an excessive amount will be deposited on the cylinder-walls and will work past the piston and up into the combustion-chamber. While this is not detrimental to actual piston lubrication, it is nevertheless to be avoided as far as possible because the surplus oil assists in the formation of carbon deposit on the surfaces of the combustion-chambers. If the oil is too heavy in body, the revolving crank-shaft will fail to throw enough on the cylinder-walls to maintain the necessary oil-film, or it may be so heavy that it cannot enter between the closely-fitted surfaces in sufficient quantities. In either case, excessive friction will follow, with rapid wear and possibility of serious damage. Under correct operating conditions frictional heat is relatively small and is absorbed and dispersed by the lubricating-oil. But insufficient lubrication increases frictional heat greatly and this may raise the temperature of the heating-surfaces beyond the point permitting lubrication, when they will begin to cut and will eventually be destroyed. In the case of cylinder-walls, the cooling-medium surrounding the cylinder may be able to carry away this surplus heat and thus prevent serious damage, but the internal friction of the engine will be greatly increased, with consequent loss of power.

If the oil is too heavy, the crank-shaft will fail to throw enough oil on the cylinder-walls to maintain the necessary film, or it may be so heavy that it cannot enter between the closely-fitted surfaces in sufficient quantities.

In this connection it is important to understand the necessity for using an oil that will not become thick under cold-weather conditions. Unless the oil will flow freely at the temperature of the surrounding atmosphere, the above noted effects of using too heavy an oil will occur when the engine is started cold. For this reason the cold-test of the oil (which is the lowest temperature at which it will flow) is an important consideration in winter weather, and the engine should never be run unless the temperature of the oil in the reservoir is above its cold-test. From this it follows that the correct oil for winter lubrication should have a cold-test below the prevailing temperature.

The motion of the pistons in the cylinders is reciprocating, or up and down, and bearings operating in this way are more difficult to lubricate than the rotating

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type, such as are found on the crank-shaft. The surface of a main journal on the crank-shaft travels continuously in one direction, and the film of oil between the journal and its bearing is easily maintained unless the pressure on the journal is great enough to force the oil out at the ends of the bearing. But we find a different condition with the cylinder-walls. The upper and lower edges or corners of the piston tend to act as scrapers and scour off the oil-film as the piston travels up and down in the cylinder. The upper part of the cylinder-wall is relieved or counter-bored so that the upper edge of the upper piston-ring on the up-stroke goes beyond or above the cylinder-bore proper and in this way tends to force some of the oil off the cylinder-wall. In the same way, the lower edge or skirt of the piston emerges from the cylinder at the bottom of its stroke and carries with it a portion of the oil-film. To resist this tendency as far as possible, and prevent entire removal of the oil-film by the action of the piston, the correct oil should have the quality of clinging to the surface of pistons and cylinders so that it will resist this action and so that no metallic contact can occur.

The oil used should have the quality of clinging to the surface of pistons and cylinders and resisting the tendency for the reciprocating motion of the piston to remove it.

The rate of speed of the pistons as they travel up and down in the cylinders is of great importance in determining the correct oil for cylinder lubrication. The higher the piston-speed, the lighter the oil that should be used. The rapidity with which the oil can enter between closely-fitting bearing-surfaces and replace the oil-film that has been displaced or worn out is dependent upon its fluidity. When the piston-speed is high, little time is allowed for this action, and for this reason the oil used should have great fluidity. At lower piston-speeds, a heavier oil may be used, although from the standpoint of piston-speed alone, the lighter oil would be satisfactory. Piston-speed in the ordinary automobile is comparatively high. Most cars when running in high gear at from 25 to 30 miles per hour will have a piston-speed of 1000 ft. per minute. In fact, this piston-speed is used as a basis for calculating the engine-power of the automobile under the Society of Automotive Engineers formula. Many cars, at maximum speed, have a piston-speed of over 2500 ft. per minute, and the average car seldom runs at a piston-speed under 500 ft. per minute. Piston-speeds in truck-engines are usually somewhat lower than in automobile-engines, but in most cases the rated truck-speed on high will mean a piston-speed of 1000 ft. per minute or more.

Piston-speed in the ordinary automobile is high and this requires an oil of light body.

These are relatively high piston-speeds and require an oil of comparatively light body. Furthermore, if the oil is heavier than is needed for efficient lubrication, we have increased friction in the oil itself, which cuts down the effective power of the engine. Oil-friction increases with the body of the oil and the speed of the bearing-surfaces, and for this reason the oil should not be heavier than is required by these and other determining factors in cylinder lubrication.

In considering cylinder-walls as bearings, we encounter the two extremes of clearance, or space between surfaces. Pistons are loosely fitted in the cylinders because the heat of combustion causes them to expand and become slightly greater in diameter. The cylinders do not expand correspondingly because they are kept at a lower temperature by the cooling-medium. Therefore the pistons are made small enough to allow for this difference in expansion. Otherwise they would seize and cut when they become heated and expanded.

The exact amount of clearance allowed by the different manufacturers will vary, but in general it is dependent upon the diameter of the pistons and the character of the metal from which they are made. In automobile and truck engines using cast-iron pistons the clearances are 0.001 to 0.002 in. per inch of piston diameter. In an engine with 4-in. pistons the average clearance would be 0.006 in., producing a space of 0.003 in. between each side of the piston and the adjacent cylinder-wall. Where aluminum-alloy pistons are used the clearance is somewhat greater, as this metal has a higher rate of expansion than cast-iron.

Such clearances as these are rather large for well-finished bearing-surfaces, and the space allowed would permit the use of a fairly heavy-bodied oil if this were the only factor governing the choice. The lubrication of piston-rings, however, presents a different problem on account of much smaller clearances.

The gases under pressure in the combustion-chamber during compression and power strokes would escape past the loosely fitted piston if no means were provided to make a gas-tight joint between piston and cylinder-wall. This 'piston-seal', as it is called, is effected by the piston-rings, assisted by the lubricating-oil. The rings bridge the gap between piston and cylinder-wall. They are held in place by grooves in the piston, and their own springiness forces them out against the cylinder-wall. The oil-film must be maintained between these surfaces; otherwise there would be actual metallic contact and excessive friction. The correct oil must be light enough in body to form a continuous film between the rings and cylinder-wall and maintain an effective piston-seal under all the varying conditions of operation. Cast-iron is the metal almost universally used for piston-rings, and this, of course, is expanded by heat just as much as the pistons. If the piston-ring were really a continuous ring of metal, it would have to be the same diameter as the piston, and would then serve no useful purpose. But it is split or cut at some point in its circumference so that it can expand without increasing its diameter and thus maintain the same clearance with the cylinder-wall. The expansion is taken up lengthwise or along the circum-

To prevent escape of gas around the piston, the piston-seal must be maintained by the use of piston-rings.

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ference of the ring, and a suitable gap must be allowed between the ends to allow for this expansion.

As heat has clearly defined effects on lubricating-oil, the working-temperature of bearing surfaces is an important element to be considered. Below the temperature at which the oil will burn, the principal effect of heat is to reduce the body or viscosity. It is necessary, therefore, to use an oil that will fulfil efficiently its various functions at the working-temperature of the pistons and cylinder-walls. The heat of combustion tends constantly to raise the temperature of the pistons and cylinder-walls. The cooling-medium, however, absorbs a large part of this heat and prevents the temperature from getting too high. Where water is used as a cooling-medium, the water surrounding the cylinders should not get above 212°F. The sides of the piston, being farther removed from the cooling-medium will be higher in temperature, but will not ordinarily exceed 300°F. in water-cooled engines.

The oil used must fulfil its various functions at the working-temperature of the pistons and cylinder-walls.

At the start of the power-stroke of the piston, it is at top-centre and none of the friction surfaces of piston and cylinder-wall are directly exposed to the flame of combustion. As the piston travels downward on the power-stroke, it exposes the working-surface of the cylinder-wall, and this is covered with a thin film of oil left there by the descending piston. This oil-film is, therefore, subjected to the direct action of the flame and heat of the burning-gases.

At the beginning of the power-stroke the temperature of these gases is approximately 2500°F. As the piston descends, the gases expand and their temperature drops, until at the opening of the exhaust-valve it is about 900°F. All oils will burn if exposed to this heat for any length of time, and consequently at least a part of this oil-film is going to burn or be consumed at every power-stroke of the piston.

For two reasons, burning takes place only in part: first, because oil burns comparatively slowly and the oil-film is exposed to this high temperature for only a small fraction of a second; second, because the oil-film is resting on the cylinder-wall, which is at a much lower temperature than the gas within the cylinder, and this to a great extent protects the oil from the heat of the combustion. The oil-film can be considered as consisting of several layers, and the outer layer, which is in direct contact with the flame, is the only part of the oil to be actually burned. Since some of the oil must be consumed by heat, the correct oil is one that will burn cleanly, leaving practically no carbon deposit. In other words, the character of the oil should be such that the products of combustion of the small part of lubricating oil burned during each power-stroke will pass out of the combustion-chamber through the exhaust-passages.

Since it is impossible to prevent burning of some of the oil, an oil that will burn cleanly, leaving practically no carbon deposit, should be selected.

Thus far in our discussion, it would appear that in the pistons and cylinder-walls of the engine we have bearing-surfaces of large area working under the most severe conditions of speed, clearance, and temperature. The final consideration, however, involves a function of the lubricating-oil, that in this case is easily performed and it is really this last element of cylinder-lubrication that prevents the total friction developed in the cylinders from becoming prohibitive.

All bearing-surfaces work under pressure, which may be constant or varying. Correct lubrication requires an oil that will not be squeezed out from between the bearing-surfaces at their maximum pressure, thus permitting actual metallic contact.

Within certain limits, the total amount of friction developed in any bearing-surface is directly in proportion to the total pressure on the bearing. As the pressure on the bearing increases, the friction increases with it. This pressure is generally estimated in pounds per square inch of bearing-surface.

The maximum pressure on the piston in the average engine is about 250 lb. per square inch. But this pressure is all in a downward direction and has no tendency to force the piston against the cylinder-wall until it starts on the down-stroke. The connecting-rod is used to convert the straight-line motion of the piston into the circular motion of the crank-pin, and, as the piston moves down, the rod assumes more and more an angular position. As the angularity of the rod increases, the side-thrust or pressure on the cylinder-wall increases until, when the rod is at right-angles with the crank, this side-thrust is at a maximum.

The total pressure on the head of the piston, however, has been decreasing as it travels downward, and at the point of greatest side-thrust, it is less than 100 lb. to the square inch. At this point the pressure of the piston against the cylinder-wall is about one-quarter of the downward pressure on the piston, or about 25 lb. per square inch of piston-head area. But as the effective bearing-area of the piston is much greater than the area of the piston-head, the maximum side-thrust of the piston, being distributed over this larger area, becomes still smaller, probably never over 15 lb. per square inch. Above and below this point in the stroke, the side-thrust of the piston decreases.

On the compression-stroke the total pressure on the piston-head is only one-quarter the pressure on the power-stroke, and the side-pressure is lower accordingly. On the exhaust and intake strokes there is practically no side-thrust on the piston, except that due to inertia of moving parts. From this it is apparent that the average pressure per square inch on the bearing-surface of the cylinder-wall is practically negligible, and the pistons really float in a thin film of lubricating-oil. When it is realized that we have bearings in the engine where the maximum pressures run from 1500 to 2000 lb. per square inch, as for instance the wrist-pin bearing, it

Given correct lubrication, piston-friction will be relatively small.

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is easy to see that, with correct lubrication, piston-friction is not so serious as it may appear.

The Standard Oil Co. of California manufactures several different grades of Zerolene to meet the various lubricating requirements of the different makes of automobiles and trucks. Recommendations as to the particular type or grade of Zerolene to be used in each make of truck or automobile are published and can be secured at any of the service stations of the company. In addition, the services of the board of lubricating engineers can be had by any operator who is confronted by problems arising in connection with the lubrication of any truck or automobile, and questions bearing on this subject will be answered at any time if presented to the company.

Employees' Representation in the Management of Industry

Causes of dissatisfaction and unrest among industrial workers were discussed by Royal Meeker, commissioner of labor statistics of the U. S. Department of Labor, in an address delivered before the American Economic Association at its thirty-second annual meeting, Chicago, Illinois. In brief, he states that the reasons for the present unsatisfactory condition of affairs may be found in the general feeling among workers that they do not receive the share of profits to which they are entitled; that their hours of labor are unsatisfactory, that industry is not as well managed as it should be; that work could be made less monotonous and uninteresting; that 'absentee landlordism' has caused indifference to the workers' interests, and that opportunities for advancement into positions of responsibility are becoming infrequent.

Mr. Meeker believes that had the War lasted longer, either a national industrial commission or a series of commissions in separate industries with district boards to take care of the local disputes would have been established. In this connection, while disclaiming any desire for continuing the War even for a day to secure this most desirable of results, he says, "We can only hope that the terrors of peace will be as potent as the horrors of war in compelling the Bolsheviki of the right and of the left to come together on a reasonable compromise." The elaborate mechanism for securing industrial peace set up by the British government through the much-discussed Whitley councils is as yet only an interesting experiment. In this country, with no well considered system of organization, he finds that democracy in industry, in spite of the plans which have been springing up in hundreds of plants, is still far less of a reality than it was even before the advent of power-driven machinery.

In reviewing the kinds of committees, their methods of organization, and the question of collective bargaining, he says that these matters are of little importance compared with the scope and content of the collective bargaining itself. As unusual examples of industrial democracy he cites, first, an instance of employees' management in an aeroplane factory in England in which the workers own half of the stock and the manager the other half, and, second, the recently organized railway adjustment board established by the British government. This board consists of an equal number of representatives of the railways and of the trade unions, and is answerable in turn, in case of disagreement, to the National Wages Board, on which the public, employer, and employees are equally represented. This experiment will be watched with great interest on this side of the Atlantic.

There is an enormous creative force in the workers. Few plans for employees' representation offer the worker any opportunity to use his latent intelligence and ability. "The workers will not be satisfied merely to express views. They want the assurance that their views will be given more than a perfunctory consideration." In addition to increasing production as a result of turning to account the hitherto unused abilities of the workers, there may be expected an increase of contentment and goodwill which will count toward industrial efficiency throughout the plant.

In the general discussion of employees' representation he thinks too much emphasis has been placed on production and not enough on distribution and consumption. It cannot be expected that the worker will maintain interest in production if he does not feel that he is getting what is rightfully his in the division of the products of the entire industry.

Admission of workers to participation in management necessitates recognition of the fact that they must also be prepared to share in the losses as well as the profits of industry. Conclusions reached by Mr. Meeker as to a fair basis on which to fix the returns of industry involve the establishment of a minimum wage which shall be guaranteed to labor no matter whether the business shows a profit or a loss, and in addition to this minimum the payment of a bonus which will vary according to the share the workers have in reducing costs of production in various ways and increasing the value of the product or of the business. This would meet the objections usually advanced against bonus schemes that the workers suffer or are rewarded, according as the managers are inefficient or successful in the conduct of the business.

SOME alleged I. W. W.'s were up before the judge the other day. All were given the usual sentences for vagrancy excepting one, who, when his turn came, declared that he had already secured a job and if allowed his liberty would be at work next day.

"So you are not opposed to work any longer?" asked the judge.

"It ain't that," replied the man with evident sincerity, "but since it's come to such a pass that two or three honest loafers can't walk together without being mistaken for an I. W. W. parade, I'm going to work."—'Los Angeles Times'.

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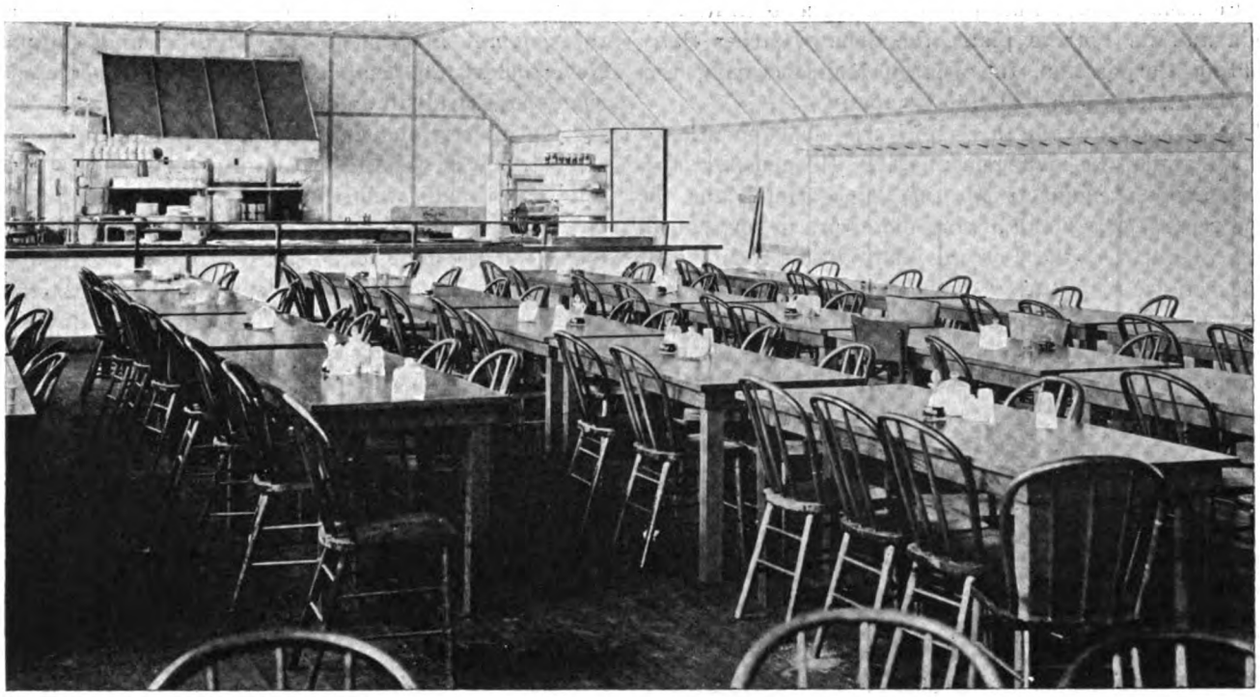

CAFETERIA OF STANDARD GAS ENGINE COMPANY

The Cafeteria in Bay District Metal Trades Plants

Time was when the 'full dinner-pail' was a campaign slogan, but that was in the days when the scientific, or the 'show me' attitude, which are one and the same, toward industrial problems was not so common as it is now. We know now that the dinner-pail, like the old oaken bucket, held within it a number of hygienic and sanitary shortcomings. In a recent article in 'Metal Trades,' Dr. Thomas Darlington tells of opening a number of lunch-boxes in a certain steel plant. The first opened contained a whole boiled cabbage and the second nothing but cake and honey.

Probably even more objectionable than the dinner-pail is the lunch obtained at the restaurant or shop in the average industrial district. After attempting to satisfy his hunger at most of such places, a man returns to work feeling as if he had a lump of lead in his stomach, and his efficiency is lowered, not only for that afternoon, but also permanently, provided he keeps up the habit.

Another factor in the problem is the effect, both physiological and psychological, when a man sits down in the shop and eats his lunch, in the same environment and breathing the same air as during his working-hours. Frequently, he does not even stop to wash his hands, although in many trades this is not only unsanitary but actually dangerous. Of course, a factory rule compelling a man to wash before eating would not be advisable, in most plants, but going into a clean dining-room has a tendency to make such an observance automatic without the promulgation of any set rule.

Considering the question from the standpoint of factory efficiency alone, a man's physical condition and consequently his efficiency is considerably increased if he eats a warm, well-cooked lunch sitting at a table in a comfortable chair in a room that, at any rate, is different from the one where he has been doing its work. If, furthermore, and this is perhaps the most important of all, the cafeteria department is managed by a man with tact and breadth of vision, the increase of goodwill and the consequent increase of efficiency, will in most good-sized plants make such a department well worth while.

Many industrial plants have maintained company dining-rooms for years with satisfactory results. The number was greatly increased during the War, partly because many factories doing war work were situated in districts where the ordinary facilities for feeding employees were inadequate, and partly because of the increased attention that began to be paid to the human factor about that time. The cafeteria plan of serving has nearly always been adopted. It permits much greater rapidity of serving than any other method, which is what the workman demands, and, furthermore, the amount of help required for only an hour or two a day with any other system would be prohibitive, particularly in a large plant. The approximate cost of kitchen and dining-room equipment at present prices, is $1000 for a 'plant' to feed 50 men at a time, and $10 per man for each additional man. This is exclusive of cost of building, which is necessarily variable.

A number of metal-trades plants in the Bay district have established company cafeterias, among them being

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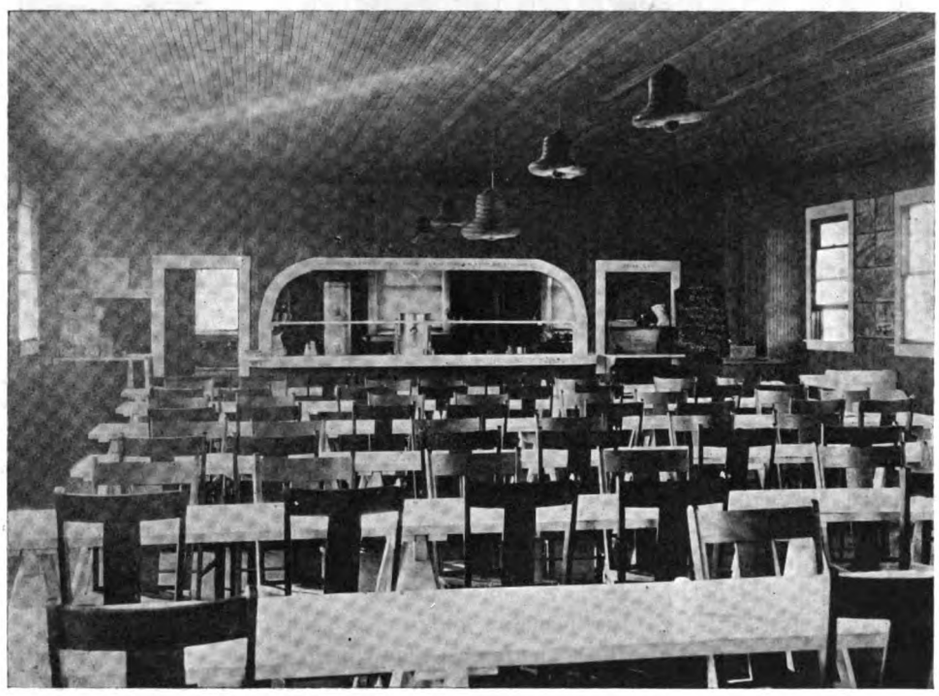
the Bethlehem Shipbuilding Corporation at both its Alameda and its Potrero plant, the Schaw-Batcher Shipbuilding Corporation, the Judson Manufacturing Co., and the Standard Gas Engine Company.

The cafeterias at the three shipyards above mentioned are all under the management of S. Hoedemaker, formerly assistant manager for the Palace Hotel, and the same general policy and arrangements are in force at all three plants. At the Potrero plant dining-room about 2000 men are served every day. Besides the noon meal, breakfast, and also supper for the benefit of men working overtime is served. At the noon meal, which is the most patronized, there are two styles of serving. A straight payment of 35 cents entitles a man to the regular meal, which consists of soup, meat, two vegetables, bread and butter, dessert, and coffee or milk. To facilitate quickness of serving, no choice among different dishes is provided with this meal. If a man wishes to make a selection he is served in the ordinary cafeteria style, and the purchasers of the 35-cent meal may also select extras in the same way. Payment is made by cash, or, when a man desires credit, by ticket. There are four serving-lines, and approximately 25 men can be served at each line per minute, making about 100 men per minute in all.



CAFETERIA OF JUDSON MANUFACTURING COMPANY. KITCHEN IN REAR

Advantage is taken of labor-saving mechanical equipment such as dish-washing machines, potato-peelers, etc. Steam-tables keep the food hot. Gas is used for cooking.

A commissary is maintained under the same management as the dining-room, articles in general demand, such as tobacco, overalls, etc., being sold. A small profit is made on these articles, which helps to make up the deficit on the dining-room. The entire department, dining-room and commissary combined, just about pays its way as far as operating costs are concerned, but makes no return on the original investment for building and equipment. Nevertheless, the company feels that the increased efficiency and goodwill among the men more than makes up for the interest and depreciation on the equipment.

The plant of the Judson Manufacturing Co. at Emeryville is unusually well-situated for establishing an attractive cafeteria building. It fronts on the eastern shore of San Francisco bay. A so-called cafeteria and recreation pier runs a hundred or so feet from shore. At the far end the pier widens to provide room for a dining-room and kitchen. Seating accommodations are provided for about 150. The dining-room is run by the company, under the direction of S. Adelson, who has made a special study of operations of this kind for a number of years.

The dining-room is amply supplied with windows on each side, ensuring an abundance of light and ventilation. The wall-spaces in between the windows are fairly well covered with photographs of subjects of general interest. The tables are made of plain wooden planks fastened to 'horses', all covered with a heavy coat of white enamel. This makes 'cleaning up' a simple operation. Ordinary straight-backed chairs of the same general type as might be used in the company's office waiting-room are used. Perhaps the whole room may be best described by the statement that it has none of the barrack-like appearance so characteristic of any place where activities of any kind are conducted on a fairly large scale.

The following bill of fare is typical of the meal served at noon, and for which a charge of 35 cents is made. The day happened to be Friday, which accounts for the fish course.

Soup
Fish or corned beef and cabbage
Potatoes Beets
Pie, cake, or pudding
Coffee or milk

Certain special 'extras' can also be purchased. The average time between a man's coming to the service-counter and leaving it with his full tray is about one minute. For the benefit of the men working overtime, sandwiches, pie, coffee, milk, etc., are served from 4 p.m. on. The main work of preparing the food and serving it is done by Mr. Adelson and two women assistants. For the rush period, which lasts about half an hour (the entire lunch period is 45 minutes), two women from the

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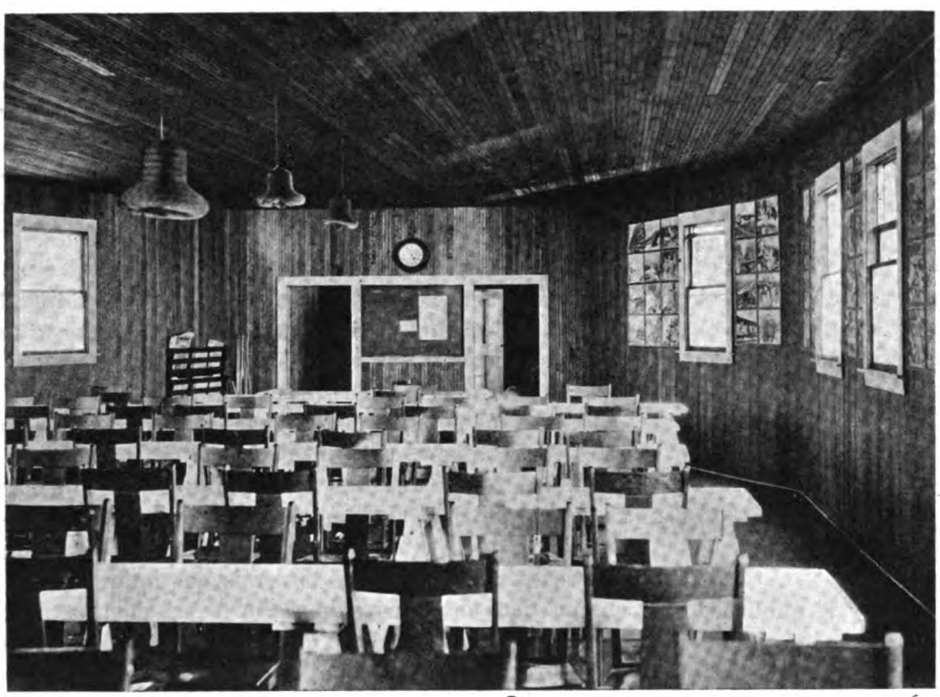
office force also come in, one to help serve and the other to act as cashier, and a man from the plant comes in to act as 'busboy'.

The kitchen is placed at the end of the building farthest from the main entrance, which is on the land side. The equipment includes a gas-range and steam-tables for keeping the food hot.

The dining-room at the plant of the Standard Gas Engine Co. was opened in January. Dining-room and kitchen are situated in a second-story structure that occupies part of the main building housing the machine-shop and assembling departments. This same part of the building also contains the first-aid room and a commissary. The commissary has just been started, and will supply foodstuffs to employees at the lowest possible increase above wholesale cost. Arrangements are also being made to equip a club-room for employees.



CAFETERIA OF JUDSON MANUFACTURING COMPANY. MAIN ENTRANCE IN REAR

The dining-room will seat 160 at a time. Tables seating ten apiece and with heavy linoleum tops forming an integral part of the table are provided. The kitchen is equipped with gas-range, steam-tables, dish-washing machine, and bread-cutting machine. Three men, a cook and two helpers, do the work. At the present time from 80 to 100 men are fed at the noon meal, which is the only one served. If the company's activities in the future require a night shift or considerable overtime work, meals will be served at other times. The regular meal served comprises soup, meat, two vegetables, bread and butter, pie, and coffee, for which a charge of 35 cents is made. This amount is nearly enough to pay operating expenses.

The concern that wishes to establish a cafeteria in connection with its plant should pay particular attention to the selection of the man that is going to run it. Not only is catering a business in itself, and one which cannot be learned in a day or even in a month, but the careful study of what the men want both in food and in surroundings frequently makes all the difference between success and failure. A little extra expense, even though it may not produce any return that will show directly on the right side of the ledger, may mean increased goodwill that is worth in plain dollars and cents many times what it cost.

In this connection it is important that the management recognize the change that has come in the ideals and demands of the average workman during the past few years. Partly on account of higher wages, and partly for other reasons, the workman now wants and demands many things of which, even a few years ago, he had not even a clear conception. Nowhere is this more thoroughly illustrated than in his meals. The old 'deep-grease and syrup' style of cooking 'doesn't go' any more. In addition to the general change in ideals already mentioned, it must be remembered that the increased use of mechanical appliances has in large part eliminated the heavy muscular effort that produced the ravenous hunger that was satisfied with anything as long as there was a lot of it. Today, the workman wants well-cook food attractively served, and is even not averse to some of the 'frills'. For instance, when Mr. Hoedemaker started operating the dining-room at the Potrero plant, many people laughed at him because he placed French pastry on the bill-of-fare as an extra. "The workman wants pie," they told him, "you won't sell enough pastry to make it worth while." At the present time the average daily consumption of French pastry is 1200.

The possibilities of using the dining-room as a nucleus for various activities to promote the welfare of employees and to increase goodwill are considerable, among the more important being the establishment of a club-room for employees and (particularly important in these days of the H. C. L.) of a commissary where employees may buy foodstuffs and other supplies at little if any increase over wholesale costs. As has been noted above, some of the companies are shaping their policy along these lines.

With good management, a plant cafeteria for which there is a real need can be brought to the point where it will nearly if not quite pay all operating expenses. An attempt to put prices high enough to allow for interest and depreciation on the original investment would probably defeat its own ends by driving custom away from

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the dining-room. Furthermore, in order to foster the goodwill that is one of the primary objects in the establishment of a cafeteria, it is essential to prevent as far as possible any feeling that the company is making money from its dining-room. Some men, of course, will believe this anyway, or, at least, say that they do, but the idea must be combatted as far as possible, the most effective way being the charging of moderate prices, even if these mean an actual loss. But, if it is undesirable to have the men believe that the company is running the dining-room at a profit, it is equally undesirable to have them get the idea that the dining-room is a form of charity 'welfare-work'. It is perhaps needless to point out that anything of this kind is always under suspicion as being a possible substitute for higher wages or shorter hours. With both the board of directors and the employees, the dining-room should as far as possible stand on its own merits as a wise investment under certain conditions, and one which makes returns partly in cash directly, and partly in increased efficiency. On this basis it must stand or fall, and given the right kind of management, it can stand.

Acknowledgment should be made to S. Hoedemaker of the Bethlehem Shipbuilding Corporation, S. Adelson of the Judson Manufacturing Co., and George Hughson of the Standard Gas Engine Co. for assistance in the preparation of this article.

Chinese Market for Internal-Combustion Engines

U. S. Consular Reports for February 9, published by the Bureau of Foreign and Domestic Commerce, includes several pages of discussion of the market for internal-combustion engines in China, written by the U. S. consuls in several of the larger cities. E. J. Woodall, consul at Canton, shows that the low cost of labor militates against the use of an engine when only a small amount of power is required. Engines are not generally used for well-pumping, irrigation, or general farm purposes. On the other hand, about 50 small electric-lighting units have been sold during the past year in the district tributary to Canton. There are four firms in Canton making engines ranging in size from 30 to 120 hp. They are much cheaper than American or European engines, but are inferior in both materials and workmanship, and consequently are inefficient and wasteful of fuel and lubricating oil. It is noted that firms that are at present using the Canton-made engines, if they plan extensions, want foreign-built engines. These local-built engines are used for both stationary and marine work.

Before the War, English engines led in the market, and even yet there are few American stationary engines. The use of marine heavy-duty engines is still in the experimental stage, although there are several vessels equipped with Diesel engines. Some owners of steam-driven tugs and launches have replaced their steam-engines with hot-bulb crude-oil engines, and there are large possibilities in this line. There are also many motor launches used for both pleasure and business, and a number of American engines have been installed. The demand, which a few years ago was for light engines of 4 to 8 hp., has now changed to one for an engine developing up to 35 hp., and capable of a speed of at least 15 miles per hour. The type now desired is a kerosene engine, with high-tension magneto ignition, arranged so that the cylinder-heads are removable.

The sale of American-made engines has suffered because they have been handled by non-American agents, who, in general, have sold American engines only when lack of supply or other conditions made impossible the sale of an engine manufactured in their own country. In order to develop the market for American engines it is necessary that a complete line of representative motors should be made accessible. American manufacturers should combine and should maintain show-rooms and demonstration-rooms in Canton. Orders cannot be placed from catalogues, especially since agents for European engines secure sales by demonstrating their engines. The practice followed by many manufacturers in the past of giving sole agencies to non-American firms should be discontinued. At the present time only one American firm handling general imports has a resident manager in Canton, and that firm does not handle machinery.

Besides the points already noted, Raymond C. Mackay, consul at Hankow, called attention to the importance of simplicity of construction and 'foolproofness' in manufacturing for the Chinese market. To get the best results the selling agent must be in a position to make immediate deliveries, as the Chinese buyer is not interested in an engine that may arrive in three to six months. Since kerosene can be obtained generally throughout China, while crude oil is sold at the principal ports only, kerosene-engines will have the wider market. In the opinion of George E. Anderson, consul at Hongkong, the extent of the market in south China for stationary engines in particular depends upon the revival of industry and the development along modern industrial lines of the small workshop in which most of the manufacturing is now done. Unlike Mr. Mackay, he believes that the crude-oil engine will be as important a factor as the kerosene engine, on account of the lower cost of the fuel. This will, presumably, apply particularly to the larger cities, while the kerosene-engine remains the favorite in the rest of the country.

A TRAVELER asked a boy if there was any good fishing in the neighborhood.

"Yes, sir," answered the lad. "You go down to that private road till you come to the sign that reads 'Trespassers will be prosecuted'. You keep on, right across the middle of that field till you get to a pond where it says 'No fishing allowed'. That's the place."—'Los Angeles Times.'

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Gears—II*

By EDWARD LESLIE

This series of articles on gearing will discuss the merits of the prevailing forms of gear-teeth. They will show graphically the evolution of the gear-tooth from the first standard tooth-form to the newer forms, which are fast gaining approval.

Fig. 4 shows a pair of standard involute gears in mesh and illustrates the various elements and terms used in the discussion of gearing, which are further explained below.

OUTSIDE DIAMETER, sometimes abbreviated O. D., is the diameter measured over the tops of the gear-teeth.

INVOLUTE BASE-CIRCLE is the circle from which the involute curve starts, from which face and flank radii are drawn. The base-circle is determined by the pressure-angle touching the pressure-angle at a radial intersection. The pressure-angle is also the line of action from the teeth as they mesh.

ROOT-DIAMETER, abbreviated R. D., is the diameter measured at the bottom or root of gear-teeth.

PITCH-DIAMETER, abbreviated P. D., is the most important gear measurement from whih all other dimensions are determined. It is a theoretical circle, or surface touching its mating circle or surface, existing geometrically in every gear, as shown in Part I of this series.

CENTRE-DISTANCE is the distance between the centres of two meshing gears, or the sum of the pitch radii of two gears that are tangent to each other.

CIRCULAR PITCH is the distance from the centre of one tooth to the centre of the next, measured along the pitch-circle and not in a straight line.

DIAMETRICAL PITCH is the number of teeth for each inch of the pitch-diameter.

ADDENDUM is the distance from the pitch-circle to the top of the tooth or outside diameter.

DEDENDUM is the distance from the pitch-circle to the root of the tooth, and is equal to the addendum plus clearance.

WHOLE DEPTH is the depth of tooth from the outside diameter to the root diameter.

FACE is that part of the tooth-curve extending from the pitch-circle to the outside diameter.

FLANK is that part of the tooth-curve situated inside of or below the pitch-circle.

PITCH-POINT is the point of tangency of the pitch-circles.

COMMON TANGENT of a pair of gears is a line passing through the pitch-point, at right angles to the centre line.

LINE OF ACTION of a pair of gears is a straight line drawn tthrough the pitch-point, tangent to the involute base-circle. Contact of teeth takes place only along the line of action. The length of tooth-contact is determined from this line.

Fig. 1 shows a cycloidal tooth, the first definite form of tooth-curve and still persisting in use because of the many patterns on hand of this form, and because of the 'natural reluctance of the average human mind to adopt

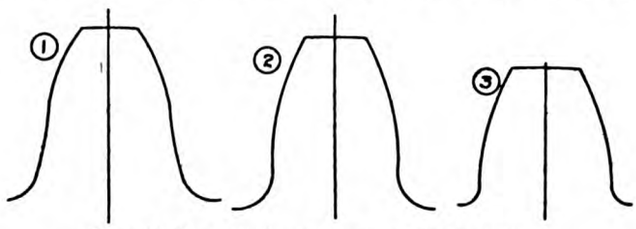

FIG. 1, 2, AND 3. TYPES OF GEAR-TEETH

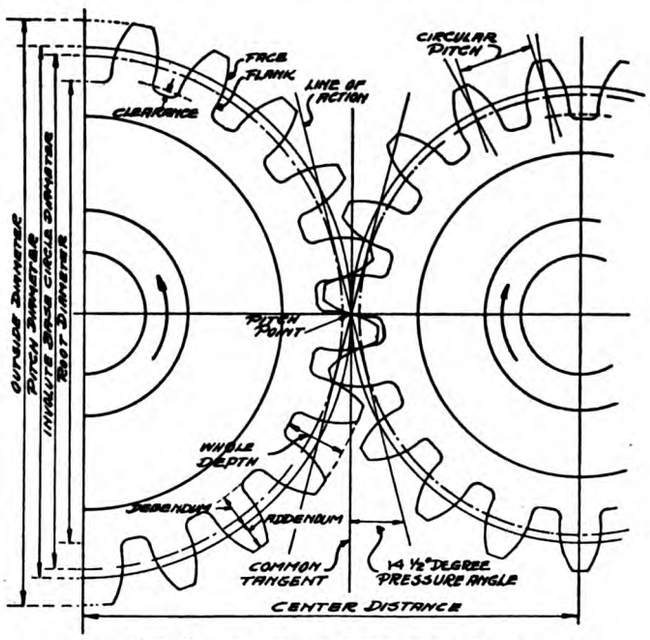

FIG. 4. STANDARD INVOLUTE GEARS

a change'. Fig 2 shows the standard 14½° involute-tooth, perhaps the most used of all tooth-curves today. Fig. 3 shows the newer 20° standard involute stub-tooth, fast gaining in popular favor, and employed exclusively by many of the largest users of gears.

TESTS have been completed at Manchester by William P. Durtnall of a new type of aeroplane-engine, which will be silent, and from which the danger of fire in the air has been eliminated. The tests were made on a converted engine that had been previously operated on the Otto-cycle system. At present the exhaust pressure of the gases in ordinary aeroplane-engines is high, producing considerable noise. Under the system used in the Bowles and Durtnall engine, the exhaust-gases leave the engine at 0.5 lb. pressure per square inch, which gives 'silent' operation. With so great a reduction of the temperature, it is claimed to be impossible to get a flame from the exhaust under any circumstances. The further claim is made that cheap heavy crude oil can be used in these engines, and that full power can be produced at altitudes up to 20,000 feet. Hawthorne, Leslie & Co., of Newcastle, are reported to have secured the rights.

*The first of Mr. Leslie's series of articles appeared in the November 1919 issue of 'Metal Trades'.

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Pyrometers*

By THEODORE G. SELLECK

There is no branch of steel treating in which the pyrometer is of greater importance, and value, than in casehardening; and there is no branch of the art in which it is so difficult to realize its full value.

In other branches of steel-treating it is possible to have, not only intimate contact of the hot-junction of the pyrometer with the steel being treated, but the two are under the unobstructed observation of the steel-treater, and comparisons of temperature by color may be made, and thereby the operator is able to work with a great deal of accuracy.

In casehardening, however, especially by the box-method, intimate contact between the steel being treated and the thermo-couple of the pyrometer is an impossibility, so far as general practice is concerned; and it has been determined by many careful tests that the pyrometer, when used to the best advantage, gives to the operator temperature readings that are only approximate so far as the temperature of the interior of his casehardening boxes are concerned. For this reason the casehardener always works at a great disadvantage, as compared to the worker whose work is constantly within his range of vision. To the casehardener the pyrometer is merely a guide by which he may reckon his course. It is not an infallible instrument that merely by being attached to a furnace is going to eliminate the human eye, or the human mind. It is first, last, and all the time, an aid to the eye.

The pyrometer is first, last, and all the time an aid to the eye.

The thermo-electric pyrometer is a simple instrument from a mechanical standpoint. It is the type of pyrometer in general use in steel-treating. Its component parts are the thermo-couple, the indicating or measuring instrument, and the 'leads' or wires connecting the two.

The thermo-couple is a loop, formed of two wires, of two different metals, welded together, but kept separated and insulated from each other except at the weld-point. This loop is drawn together until the two wires are parallel with only sufficient space between them to allow for proper insulation. The weld-end of the loop is known as 'the hot-junction' and is placed in the furnace at the point where the temperature conditions are the most constant, and most apt to give the average temperature for the furnace-chamber. At the other end of the loop, 'the cold-junction', the wires of the thermo-couple are connected to the 'lead wires', leading to the instrument, where its intensity is measured and reduced to degrees of heat. The temperature indicated is the difference between the temperature of the hot-junction and that of the 'cold-junction' of the thermo-couple.

The important thing for the steel-treater to remember is that the temperature indicated by a pyrometer is the difference between the temperatures of the hot and cold ends of the thermo-couple attached to it. He should also bear in mind that the temperature indicated is confined to the area at the point of the thermo-couple, and may be higher, or lower, than any other point in a furnace. Therefore it is a matter of great importance that the hot-end of the thermo-couple should be in as intimate contact as possible with the material under heat. It is in losing sight of these important facts, or in ignoring them, that lack of intelligence is sometimes displayed in the use of the pyrometer.

The temperature indicated by the pyrometer is confined to the area at the point of the thermo-couple, and it may be higher or lower than at any other point in the furnace.

It is rarely possible for the steel-treater to have all of the parts being treated in a furnace in close contact with the thermo-couple, but if he is intelligent he makes use of his eyes, and, by making comparisons of the colors of steel and thermo-couple, he is able to work with a high degree of accuracy, and the pyrometer proves a real help to him. If, on the other hand, he uses his eyes only to watch the pointer of the instrument, that instrument is quite likely to prove a disappointment, and an expensive nuisance.

Since the thermo-couple, and its hot-junction, is the point of contact between the metal being treated and the instrument, and is the basis of the indications of temperature shown by it, it is important that it should be properly placed in the furnace. In all casehardening operations the placing becomes a matter of judgment on the part of the operator, since no rule can be established that would apply to all cases. But it should never be placed in the hottest part of a heating-chamber, if there is such a part, nor should it be placed where the lowest temperature exists. When possible it should be placed where it may be seen, so that comparisons of color may be made between the couple and the boxes.

Where a large number of boxes, or pots, are placed in the furnace the thermo-couple should be so placed as to be subjected to the average temperature of the boxes, and, preferably, within sight of the operator.

The comparison of colors mentioned above has nothing in common with the determination of heat by color, as we generally speak of it, but means that the operator should be able to judge closely the uniformity of the temperature of his furnace charge by the uniformity of the heat-colors throughout the furnace-chamber. His

*Abstract from 'Journal' of the American Steel Treaters Society.

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observation should enable him to discern a difference if it amounts to 50° or 100°, and before he accepts the report of his pyrometer, that the furnace is at a carburizing temperature, he should use his eyes and prove the truth of the report. It is quite possible to have the end of a thermo-couple at a carburizing temperature when the furnace, as a whole, is several hundred degrees below such a temperature. Hence the importance of having the thermo-couple within the range of vision and using the eyes to confirm the instrument's record.

In a certain furnace the pyrometer equipment and its installation was of a high character, but the furnace manufacturer, or whoever was responsible for setting the thermo-couple, showed a marvelous lack of judgment. The furnace chamber contained nine carbonizing-boxes placed in three rows, the front row being close to the door of the furnace. The thermo-couple was placed in the rear of the chamber, in a spot entirely protected from any fluctuations of heat that might occur by reason of cold air leaking through the door, and was so close to the flue leading from the combustion-chamber that it was really in the hottest part of the furnace.

In the casehardening operations carried out in this furnace a temperature of 1600°F. is maintained for a period of five hours, that is, the temperature of that particular spot in the furnace is maintained for five hours. The operation is timed from the minute the pyrometer shows that the temperature is back to 1600° after the furnace has been charged with the cold boxes; the foreman believing that when the furnace temperature is established at that point the boxes are saturated with heat of that degree. This opinion is held in spite of the fact that a large proportion of the parts carburized do not pass inspection. This foreman would be better off without a pyrometer, because his belief in it, and his application of it are sure to bring disaster. There can be no question as to the accuracy of his instrument in determining the temperature at the point where the thermo-couple is situated, but what the relation of the temperature is to the temperature of the front row of boxes, and to the interior temperature of any of the boxes, is something he does not take into account, and has made no tests to determine. If this man had no pyrometer on which to lean, he would make use of his eyes, those exposed boxes would get what was coming to them, and his work would improve.

Placing the thermo-couple through one of the vents of a gas furnace is poor practice. There is no part of the furnace that is so likely to have a fluctuating temperature as the vent, and, besides, unless the vent is entirely closed, the couple will deteriorate rapidly from the hot gases that constantly play around it.

The care of the pyrometer is fully as important as the proper placing of its thermo-couple. The elements contained in the wires of a couple are of such a nature that the carburizing gases, if they are permitted to come into contact with it, cause the couple to deteriorate and lose its efficiency in a short time. For that reason a thermo-couple should never be used in carburizing furnaces without being protected by a tube that will be impervious to carbon-monoxide gas. Ordinary pipe-tubes are very poor protectors, as they soon become worthless when high temperatures, above 1500°F., are constantly applied to them. Nickel-chromium steel tubes are the most durable and, in the end, the most economical, although 'calorized' tubes are used to quite an extent and with considerable satisfaction, and their cost is considerably below that of nickel-chromium.

The insulation covering the wires of the couple should be watched carefully and kept in perfect condition, otherwise the delicate current may be lost or so interrupted that accurate readings cannot be obtained with certainty. If the thermo-couple is not properly insulated and the wires, or either one of them, come into contact with the protecting tube, you will not get a correct reading, if you get any at all. The same may be said of the 'leads', if the insulation is broken and the wires come in contact with any other metal the instrument will give a false reading.

In the constant use of the pyrometer there is a corresponding loss of efficiency because of physical changes in the metal of the thermo-couple, whereby the resistance of the metal to the small electric current is changed. This is corrected by calibration, which may be accomplished by the operator, or the thermo-couples may be sent to the maker. Where several thermo-couples are used a special couple should be kept for the purpose of checking them up from time to time that their accuracy may be maintained.

The thermal treatment of steel can never be made absolutely mechanical.

The thermal treatment of steel can never be made absolutely mechanical; the 'human element' will always be an important factor in the successful operation of the forge and the furnace. Neither can the thermo-chemical treatment (carburizing) of steel be made wholly mechanical. The 'human element' is no less important in this branch of the steel-treating art than in any other, and the remark so often made by superintendents, foremen, and purchasing agents that 'any dub can caseharden steel if you give him a pyrometer', shows either a profound ignorance of the process, or a disregard of the factor of quality in the operation of it.

It is conceded that 'any dub' can take a furnace, some iron boxes, or pieces of iron pipe and some carburizer (of any sort whatever) and get some sort of hardened surface on the steel he packs and subjects to heat in the furnace, if he gets the temperature high enough. But why give him a pyrometer? If his is a 'dub' he will be as much of a 'dub' with a pyrometer as without one; a pyrometer never made a steel-treater more efficient unless he already possessed intelligence.

The pyrometer is a great educator, and it will broaden the knowledge of any man who studies as he uses it. Only by its use can the value of heat-colors be learned with any degree of accuracy, but it would be worthless for that purpose in the hands of a color-blind man, and many a man who tries to work steel is in that very con-

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dition without his employers' knowledge of the fact. This belief that men of no intelligence can do casehardening as well as more intelligent men, leads to placing in the hardening-room the help that cannot be used elsewhere in the plant, because of physical or mental deficiency, because 'the pyrometer will keep him straight'.

If the pyrometer could and would do all that some users of it imagine it capable of doing, it would be the most remarkable instrument ever invented. To say that 'any dub can caseharden steel' is like saying that 'any dub can work high-speed steel'. He can. But the difference between the work of 'the dub' and that of the careful, efficient, intelligent steel-treater will be apparent in either case.

When the casehardener receives steel parts to be carbonized, he gets 'raw material'. No matter how much previous working, or heat-treatment it may have had, it is not fit for the service for which it is intended until he has performed the carbonizing operation upon it and changed its character, both chemically and physically, and made of it a new metal, a composite metal that will yield greater service by adding resistance to wear. If the work is done properly it will give 100% efficiency in the sphere of service where it is finally placed; if not properly done it will fail utterly and may bring a heavy loss.

Such development of the character of steel may be accomplished with considerable ease when but one piece is involved, and without much chance of failure, but where mass production is required, and every piece must pass the most rigid tests, the successful casehardener rises above the grade of 'A Dub' and he surrounds himself with every modern and scientific means of helping him to keep his production up to the highest grade of quality. The chief and most popular of these modern aids is the pyrometer, and he uses it as an aid to his knowledge and intelligence, never in place of them.

But it Does Not Mean Anything*

Mr. Chairman, fellow-members of the Bayville Chamber of Commerce, and gentlemen. It is a great pleasure for me to be with you once more after the months spent in toilsome sessions at Washington. In no place do I feel so thoroughly at home as I do here in Bayville. (Applause). Perhaps that is because I have always lived here.

Your chairman has asked me to discuss in a few words the question of the right relations between Labor and Capital. It is a subject that is very near to my heart. And I trust that my natural sympathies with Labor will not interfere with my giving Capital its just due. For, while it has been only during the past few years that I have acquired any capital, I have always been a laboring man. Once, as a boy, I drove a delivery-wagon for three weeks. And, if anyone thinks that political campaigning and going to Congress is not labor, all I have to say is 'Let him try it'. (Laughter and applause.)

In discussing this important subject we must keep very clearly in mind, first, that the ideals of the founders of the republic of Washington, of Hamilton, of Burr, of Buchanan, of Lincoln, and of McKinley must be preserved, and, second, that the hydra-headed specter of Bolshevism must be destroyed. (Applause.) We must remember that the workingman is entitled to a living wage, and that, furthermore, a new desire is rising within him for an opportunity to press on despite obstacles to a larger life. This larger life we should not, we cannot deny him. (Applause.)

But it must not be forgotten that the employer too has his rights, and I would be the last person to deny them to him. The founders of our great Nation, when they wrote in that incomparable document, the Constitution of the United States (loud applause), the statement that every man is entitled to life, liberty, and the pursuit of happiness, clearly indicated, since the happiness of most men is to make money, that the employer is entitled to a run for his. How far that run should extend is a question for the courts to decide. And in this connection I wish to state very forcibly that Bolshevism and profiteering must alike be destroyed. (Applause.)

And now we come to the rights of that great innocent third party, the Public, too often, alas, ground between the upper and the nether millstone of Capital and Labor. As that immortal palladium of our liberties, the Declaration of Independence (tremendous applause) says, all men are born free and equal, but that does not apply to credit at the corner grocery. I ask you, gentlemen, did our forefathers, or was it five fathers, starve at Valley Forge, did our boys fight at Chateau Thierry and the Argonne to make this noble country safe for the profiteer? (Cries of "No! No!") In every dispute between Capital and Labor, the interests of the Public must and shall be considered. And I look for the Day when, that snaky trail of that hydra-headed monster, Bolshevism, having been eliminated from our fair Land, this Nation shall stand forth United under one Purpose, even as it is United under One Flag. (Standing applause.)

[Editor's Note. Perhaps Mr. Debunque's oratory is a little bit wilder than the average on such occasions, but the difference is relatively slight. Are not sloppy thinking and the fear of offending somebody the cause of a great deal of our present-day troubles? How much longer are we going to continue 'to fall for' that sort of thing?]

An old farmer and his wife were standing before their pigsty looking at their only pig, when the old lady said: "Say, John, it will be our silver wedding tomorrow. Let's kill the pig."

John replied with disgust: "What's the use of killing the poor pig for what happened twenty-five years ago." —'Successful Farming.'

*Address of Hon. Henry Debunque at the annual dinner of the Bayville Chamber of Commerce.

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Seventy Years of Organized Labor in San Francisco

By JOHN F. JOHNSTON

For many years San Francisco has been considered one of the strongest union labor districts in the country, and although the present solidarity of the local union organization dates back only about twenty-five years, the history of the local labor movement begins with the days of the forty-niners, many of whom brought with them a knowledge of the advantages of organization among laboring men.

As soon as the boom started in San Francisco in 1849, there developed a great demand for carpenters and teamsters, and these trades were organized almost immediately. In 1853, organized labor secured legislative enactment of the ten-hour day, and, during the next few years, under the impulse of this success, nearly every important group of workers became strongly organized, including even the musicians, who struck in 1856 for the enforcement of the union-scale. It was, of course, impossible for the boom to continue indefinitely, and, as the unions were wholly local in character and dependent upon the prosperity of the city, they gradually lost their power. The unions finally broke up so that, with the exception of the Typographical Union, which had national affiliations, organized labor had ceased by 1860 to become a controlling factor in San Francisco.

The outbreak of the Civil War produced a great change because the cutting off by the Confederate navy of supplies from Eastern points made it necessary for California to become more nearly self-sustaining. San Francisco boomed again, with the result that employment was abundant and wages were high. The various trades again strengthened their organization and in 1863 formed the first central labor council of California under the name of the San Francisco Trades Union. This organization, finding wages and other conditions satisfactory, turned to the agitation for an eight-hour day, and to the extension of the trade union movement.

Three years later, in 1867, the Mechanics State Council came into existence for the purpose of securing the eight-hour day, which became fully effective in San Francisco even before the enactment of the eight-hour law in 1868. The State Council was affiliated with locals in the outlying towns and by 1870 claimed a membership of eleven thousand. It was an active organization in all matters affecting the workers, but, unfortunately, the politicians attempted about this time to gain control in order to form a local labor party, and the immediate result was to disrupt the organization and reduce it in a few years to a negligible quantity.

The completion of the transcontinental railroad in 1869 brought in large numbers of cheap workers from the East and quantities of Eastern goods. The demonetization of silver caused the shut-down of many Nevadan mines and the labor thus thrown out of employment came to San Francisco. The natural result was that the prosperity of the old times began to wane, wages fell, and the ten-hour day returned, so that discontent became general. In the late 'seventies the storm broke in the form of an anti-Chinese agitation, led by a political organization called 'The Workingmen's Party of California', dominated by Denis Kearney, and with the slogan 'The Chinese must go'. The Workingmen's Party, because of its agitation against coolie labor, land monopoly, corrupt politics, and the power of public-service corporations, was able to carry the State election in 1878 and through control of the constitutional convention, elected at that time, gave California its present State Constitution, which, when first adopted, was considered extremely radical. Henry George was in San Francisco at this time, and it was here that he first felt the need of a different system of taxation which he thought would prevent the objectionable conditions of that time by abolishing private ownership of land.

The success of the Workingmen's Party encouraged the unions, and in 1878 a new organization was formed under the name of 'The Representative Assembly of Trade and Labor Unions'. This movement was at first unfortunate in its leadership and did not accomplish much, so that unemployment and low wages continued. About 1880 Frank Roney, a molder, took the lead in the organization, and, as a result of his remarkable efforts, more than forty-five unions were brought into the Assembly and a good deal of industrial and political power was exerted. It was difficult, however, in the absence of big issues, to hold the interest of the workers, and, by 1885, the Assembly had completely dissolved. The decline of the Assembly was perhaps hastened by the growing influence of the Knights of Labor, which, at this time, included about twenty-five unions in the central California district. The break-up of the Knights of Labor as a national body had, however, began, and soon it, like the Assembly, was no longer a factor of any consequence.

Although the Representative Assembly passed out of existence in 1885, many of the union men of San Francisco still felt the need of a central body, and out of a labor convention held to protest against the continually increasing immigration of Chinese came 'The Federated Trade and Labor Unions of the Pacific Coast', which grew rapidly. This organization did some important work, and laid the foundation of the present trade-union movement in San Francisco. It did much to exclude the Chinese, popularize the Union label, secured the eight-hour day for public employees, and, after spending thousands of dollars, secured the adoption of the Australian ballot by the State legislature. With its increasing

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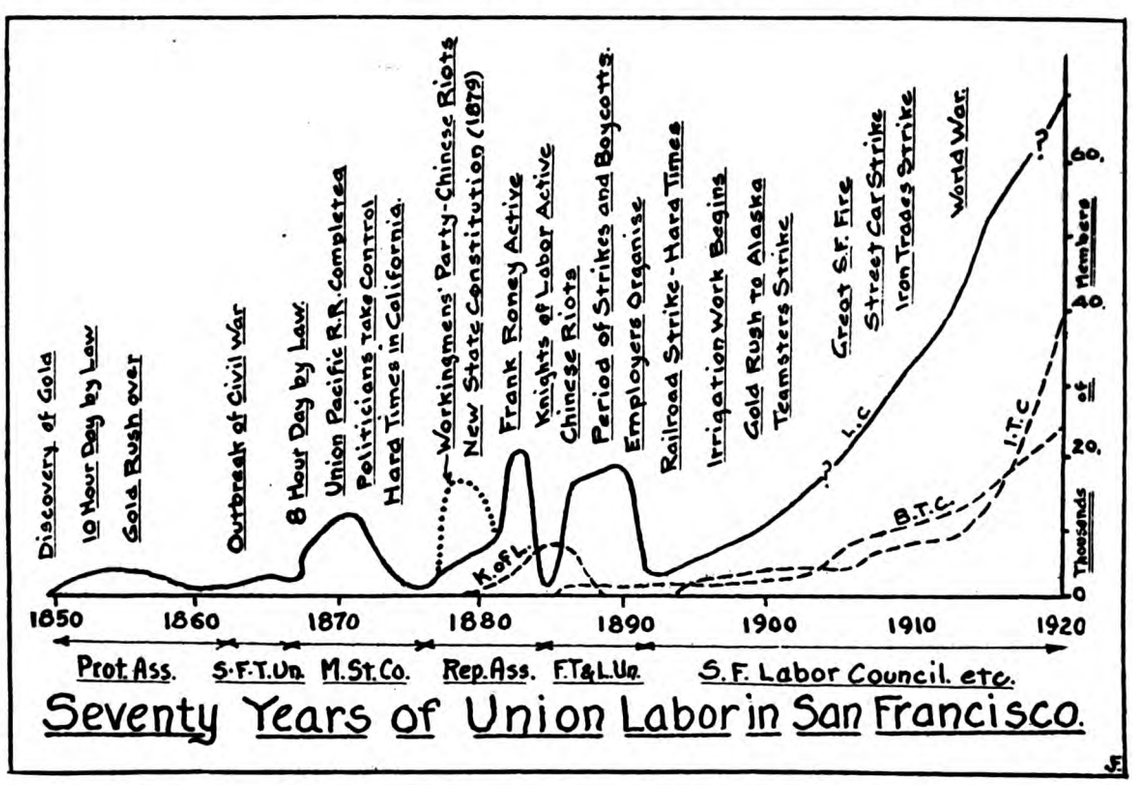
strength, the Federation, intoxicated with its power, launched a campaign of strikes and boycotts, which nearly demoralized the business of the entire Coast. Such direct action so alarmed the employers that they undertook several determined attacks, which finally in 1891 culminated in breaking up the Federation, leaving only the printers' union intact. Soon after this, in 1893, the employers again combined and through co-operation with the ship-owners severely defeated the Seamen's Union, which had been growing rapidly in strength and power since its organization by Andrew Furuseth in 1885.

The labor movement was too thoroughly established to give up for long and, in spite of the almost unparalleled stagnation of industry and the opposition of employers, the San Francisco Labor Council was launched in December 1892. This organization has continued to the present day and has been an active and effective force in the industrial life of the city, although not, on the whole, in a militant way. The best-known activities of the Council are the railroad strike of 1894, the teaming and iron-trades strike in 1901, and the street-car strikes of 1902 and 1907. In 1902 it began the weekly publication of the 'Labor Clarion', and by 1915 had a membership of about 150 unions representing over 50,000 workmen in various trades, most of which were from 90 to 100% organized. Although its interest in the labor movement is chiefly to assist in clearing up jurisdictional disputes and to promote the labor movement as a whole, its political power in San Francisco is well-known. On more than one occasion the Union Labor Party has been in complete control of the city government and the president of the Building Trades Council has occupied the Mayor's chair.

The unions that compose the Labor Council are at present also organized in various allied councils, notably the Building Trades Council, the Iron Trades Council, the Provision Trades Council, and the Allied Printing Trades Council, and it is by these bodies that the real power is wielded.

Chief among these Allied Councils are the Building Trades Council and the Iron Trades Council. The former was organized in 1894 with a membership of about 200, chiefly through the efforts of its first and only president, P. H. McCarthy. It established its weekly paper, 'Organized Labor', in 1899, and since 1901 has practically dictated terms of employment in the building trades. It was for a long time an active and powerful competitor of the Labor Council, with which it would not co-operate for many years, even going to the extent of refusing to join with it in the Labor Day celebration or to permit its constituent unions to affiliate with it. In 1910 the Building Trades Council was forced by the American Federation of Labor to permit affiliation, although to the present day it is only nominally a part of the Labor Council, and acts for and by itself as a powerful and militant organization.

The Iron Trades Council is an important body in the labor movement of the Bay district at the present time because of the great expansion of the shipbuilding industry. It was first organized in 1885, was re-organized in 1901, and has always acted in an advisory capacity to its constituent unions. Contrary to the practice of the Building Trades Council, the Iron Trades Council has always been a strong advocate of collective bargaining, although it has never employed the strong-arm tactics of the building trades to hold its constituent members in line. The division of the shipbuilding industry between



MEMBERSHIP OF LABOR ORGANIZATIONS IN SAN FRANCISCO FOR THE PAST 70 YEARS

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Alameda and San Francisco counties and the presence in the membership of a strong radical element, has served partly to disrupt the Iron Trades Council. The result has been to magnify jurisdictional difficulties and to affect adversely the relations between the Iron Trades Council and the employers. At the present time, the metal-trades employers are operating under an open-shop policy following a general metal-trades strike in October 1919, for higher wages and a more nearly closed shop. It is too early yet to determine the effect of this open-shop movement upon San Francisco organized labor as a whole, but it undoubtedly constitutes a serious setback for the Iron Trades Council.

In conclusion, reference is made to the diagram shown with this account of organized labor in San Francisco. This diagram is constructed as nearly to scale as available records permit, and while it is probably not entirely correct, it at least indicates clearly the fact that the labor movement, like all social phenomena, has its ups and downs in response to economic and political developments. It should be pointed out in connection with this diagram that in the early days membership in the unions was in a varying degree restricted to the skilled craftsmen, and that, at the present time, the membership includes various grades, down to and including common labor. This fact to some extent explains the great increase in membership during the last ten years, and should be borne in mind when forming conclusions based on this increase.

Autogenous Welding of Boilers and Pressure Vessels

The following report has been adopted unanimously by the Steam-Boiler and Fly-Wheel Service Bureau, which consists of representatives of all the companies writing boiler insurance in the United States:

By 'autogenous welding' is meant any form of welding by fusion, that is, where the metal of the parts to be joined or added metal used for the purpose is melted and flowed together to form the weld. Such welding is accomplished by the oxy-acetylene, hydrogen, or other flame processes, or by the electric arc; no distinction is made between any of these processes. The general rule to govern the acceptance of such welds in ensured vessels is that prescribed by the Boiler Code of the American Society of Mechanical Engineers, paragraph 186, as follows: "Autogenous welding may be used in boilers in cases where the strain is carried by other construction which conforms to the requirements of the Code, and where the safety of the structure is not dependent upon the strength of the welds."

The following illustrations will serve to point out where such work should be accepted or rejected.

1. Any autogenous weld of reasonable length will be permitted in a staybolted surface or one adequately stayed by other means so that, should the weld fail, the parts would be held together by the stays. It is necessary for the inspector to use judgment in interpreting the meaning of 'reasonable length' as given above, since it may vary in different cases. In the average case it should be not more than 3 ft. Autogenous welding will not be accepted in an unsupported surface.

2. The edges of the inner and outer sheets of vertical fire-box boilers, or boilers of the locomotive type, may be joined by autogenous welding to form the door openings, if the surrounding surfaces are thoroughly stayed. This would also apply to other openings of a similar character in such surfaces.

3. For low-pressure plate-steel boilers operated at a pressure not exceeding 15 lb. per square inch, or for higher pressures in unfired vessels subjected to water presure only, rectangular headers may be autogenously welded at the edges if the sheets are properly held together by stays. Autogenous welding of cracks and fractures in cast-iron boilers will not be permitted.

4. Fire-cracks in girth-seams extending from the edge of the plate to the rivet-hole may be autogenously welded provided the cracks are properly prepared by cutting out the metal at the crack in the form of a letter 'V' to permit fusion through the entire thickness of the plates. Similar cracks in girth-seams between the rivet-holes may also be autogenously welded, provided the cracks do not extend beyond the edge of the lap of the inner plate. In the latter class of cracks it is advisable to drill a hole not exceeding $\frac{3}{8}$ in. diam. at the end of the crack before a weld is made. Cracks extending from rivet-hole to rivet-hole on girth-seams should not be welded. Calking-edges of girth-seams may be built up by autogenous welding between the rivet-holes and calking-edge where the original section of the metal to be built up on an average is equivalent to one-fourth of the diameter of the rivet-hole; and the part of calking-edge to be replaced does not exceed 30 in. long in a girthwise direction. In all repairs to girth-seams by autogenous welding, the rivets must be removed over the parts to be welded and for a distance of at least 6 in. at each end beyond such parts. After repairs are made, the rivet-holes should be reamed before the rivets are re-driven.

5. Stayed sheets that have corroded to a depth of not more than 40% of their original thickness, may be reinforced or built up by autogenous welding. In such cases the stays shall come completely through the reinforcing metal so as to be plainly visible to the inspector.

6. Where tubes enter flat surfaces and the tube-sheets have been corroded or where cracks exist between the tube-ligaments, autogenous welding may be used to reinforce or repair such defects. The ends of such tubes may be autogenously welded to the tube-sheets. The above-mentioned repairs for tube-sheets and the welding of tubes in the sheets, are not to be permitted where such sheets form the shell of a drum or boiler, as in the case of the Stirling type of boiler.

7. When external corrosion has reduced the thickness of plate around hand-holes to not more than 50% of the

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original thickness and for a distance not exceeding 2 in. from the edge of the hole, the plate may be built up by autogenous welding.

8. Pipe-lines will be accepted where the flanges or other connections have been welded autogenously, provided the work has been performed by a reputable manufacturer and the parts properly annealed before being placed in position. Such welding when made with the part in place and unannealed will not be acceptable.

9. Autogenous welded patches in the shell of a boiler will not be acceptable regardless of the size of such patches. Autogenous welding of cracks in the shell of a boiler (except those specified in paragraph 4) regardless of the direction in which they may lie will not be permitted, unless such welding is only for the purpose of securing tightness and the stresses on the parts are fully cared for by properly riveted-on patches or straps placed over the weld. The plates at the ends of joints may be welded together for tightness, provided the straps or other construction are ample to care for the stresses on the parts so welded.

10. Re-ending or piecing of tubes for either fire-tube or water-tube boilers by the autogenous process will not be permitted.

Factors to be Considered in the Heating and Cooling of Steel

In a paper presented before the American Steel Treaters' Society, C. D. Barnhart, of the firm of W. S. Rockwell & Co., furnace engineers, listed the factors governing the heating and cooling of all material, whether a loaf of bread or an ingot of steel as temperature, time, surface, and mass.

The importance of temperature, or the degree of heat required in the product to produce a given molecular formation and grain structure, is more generally appreciated than the other three factors involved.

The time-factor is represented by the period required to saturate the piece to the required temperature and to permit the required metallurgical reaction of diffusion and equalization.

The surface-area of the individual piece exposed to the heat influences the rate of absorption of heat, the time of saturation, and the degree of uniformity throughout the piece.

The mass of the body to be heated influences the time required for saturation, the rate of absorption, and the manner of exposure to the heat. Mass should be considered with reference to the individual piece and with reference to a mass composed of a number of individual pieces.

Temperature and time are the two basic factors. The temperature is determined by the metallurgical requirements. The time-period is based primarily on the factors of surface and mass. Due regard must be paid to the nature of the material itself. For instance, the time required for the proper saturation of a low-carbon steel may differ from the time required for a high-grade alloy-steel of identical surface and mass. In annealing, the time allowed for heating or cooling is generally too short, particularly with large pieces. This statement also holds good in some cases for heating for other purposes, particularly where there are large surfaces in proportion to mass, as in the heating of large circular saws for hardening.

The time required for the proper saturation of a low-carbon steel may differ from the time required for a high-grade alloy-steel of identical surface and mass.

It is desirable to expose to the heat as much of the surface of the individual piece as possible. This holds good whether the operation is one of heating a single piece as a mass or of heating a quantity of smaller pieces. This done, the only other element seriously affecting time is the mass, whether it is the mass of the individual piece or the mass of a quantity of pieces. When heating or cooling a number of pieces at the same time, it is desirable to avoid the large-mass effect in order that there shall be no material variation in the surface-area of each piece exposed to the heating or the cooling atmosphere. In such cases it is desirable to break up the mass so as to reduce the depth of material and to increase the surface of the material exposed to the heat. This generally reduces the time required and results in exposing each piece more nearly to the same temperature for the same time, instead of subjecting the outside of a dense mass for a longer time than the pieces at the centres.

It is desirable to expose as much of the surface of the individual piece as possible.

The ideal cooling condition is approached when due consideration is given to these same factors. An illustration of this, from the standpoint of heating, would be to consider the difference in uniformity of a product such as small balls or bolts when piled in a large mass on the hearth of a stationary furnace, or when passed through an automatic furnace in a thin stream or layer. In cooling there would be a pronounced difference in uniformity from plunging such a mass of heated material into a non-circulating bath compared with dropping a few pieces at a time into a circulating bath.

In heating large dies it is desirable that they be thoroughly saturated at a temperature slightly below the final temperature before the formed corners or edges on the face reach the final temperature. As the life of a die is no greater than the life of the corners or edges, every possible effort should be made to prevent

Large dies should be thoroughly saturated at temperature slightly below the final temperature before the formed corners or edges of the face reach the final temperature.

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overheating the corners or exposing them to the final temperature any longer than is necessary. The corners of the piece are the first to heat and the first to cool, and it is there that the evil effects of unequal contraction are manifested. These corners heat and cool more rapidly because the surface in proportion to the mass of these sections is much greater than that of the body of the die. With such dies it is essential to consider the difference in time required to reach a given temperature in heating or cooling, because of the difference in surface and mass of the sections forming the outline of the piece to be formed and the body of the die itself. Improper heating and cooling, caused by a disregard of these factors, are responsible for a great deal of the limited service and loss of production, material, and labor. Such loss more than offsets any saving in time or fuel obtained by attempting to heat the piece quickly without due regard to all the factors involved.

The difference between a small piece and a large one is mainly one of degree, insofar as these points are concerned. The principles hold good in either case. When a quantity of small pieces is heated indifferently, those on the outside of the charge are likely to be affected in the same way as the corners of the die, and while, in one case, it is only those outside pieces that are spoiled, in the case of the die the entire piece is ruined. The total cost of heat treatment of a small piece is not large and the difference in cost between proper and improper methods is surprisingly slight. The difference in results is all out of proportion to the cost, and it is good business to bear the slight extra cost in order to produce a superior product, which will prove cheapest in the long run. Frequently a piece may be properly heat treated by a suitable method more cheaply than by an inferior one.

The lack of consideration commonly shown for these points accounts for the variations that so often occur in the finished product without any apparent change in the indicated temperature. No matter how elaborate the pyrometer or temperature-recording system may be, good results cannot be secured unless the factors of mass and surface are considered along with the temperature and the time.

No matter how elaborate the pyrometer or temperature-recording system may be, good results cannot be secured unless the factors of mass and surface are considered along with the temperature.

The practice of charging and discharging material to or from a furnace without regard to these factors, but with an eye only to the pyrometer, seems to be more of a job of manufacturing pyrometer-records than of producing a uniformly heated product. The manner of exposing a piece to the heat is just as important as the manner of indicating the temperature to which it is exposed. The pyrometer does not necessarily indicate the temperature of the material but merely the temperature of that part of the chamber in which the couple happens to be situated. Like the gauge on the steam-line, it indicates the existence of heat-energy but it does not necessarily indicate the use made of that energy. The indicated temperature must be considered with the element of time and with the influence that the factors of mass and surface have upon the time. The only test worth while to determine these points is the degree of structural uniformity disclosed by the microscope. A laboratory determination of temperature, with a surface exposure different from that likely to obtain in the shop, is frequently responsible for material variations in quality disclosed by physical tests, in spite of evidence in the form of pyrometer-records to show they should not exist.

The manner of exposing a piece to the heat is just as important as the manner of indicating the temperature to which it is exposed.

There is a waste of effort in the average heating test, which generally involves nothing more than an investigation of fuel consumption or temperature variation, without regard to the other important points involved in the process of producing properly heated material. Such tests are useless in determining the value of a furnace from the standpoint of heating material. If the average furnace were designed and operated as intelligently as the automobile there would be much less ground for complaint. With the automobile, fuel is considered but one factor in the transportation results required, and it should be considered in the same light with furnaces for the production of results in the form of heated product. It is the results in transportation that test the automobile, and it should be the results in uniformly-heated product that test the furnace.

The trade needs a better appreciation of these points and of the fact that the real goal is the production of quality product at the lowest cost, and that it is invariably cheaper in the long run to do it right than in a haphazard fashion. While heat treatment should be considered as an art or trade, the principles involved are not complicated or mysterious. If the heat-treating public can be led to a common-sense consideration of these principles there will be an improvement in methods as well as in quality and cost of operations.

For the first time in the history of the industry, the coke produced in the United States from by-product ovens in 1919 exceeded the amount produced in beehive ovens. As compared with 1918, when the highest production ever known was recorded, the by-product output nearly held its own, although the beehive output was reduced considerably. The figures for 1918 were 25,997,000 tons for by-product and 30,481,000 tons for beehive ovens, while the 1919 estimates are 25,000,000 tons and 19,650,000 tons respectively. In 1893 the production of by-product coke was only 13,000 tons.

It was the wedding supper and in the midst of the revelry a telegram came. Thinking that it must be a message of congratulation, the groom asked the best man to read it aloud. Imagine the consternation when that worthy read:

"Hope you have better luck than we did," signed by the bride's two ex-husbands.—'Los Angeles Times'.

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The Hump Method of Heat Treatment

In a paper presented before the American Steel Treaters' Society, George W. Tall, Jr., of the Leeds & Northrup Co., discussed the 'hump' method of heat treatment, which is described in detail in U. S. Patent No. 1,188,128. It was developed at the company's plant by Jordan Korp and William J. Wrighton for treatment of tools, principally punches and dies. It has also been applied to the treatment of ball-bearing races, transmission and differential gears, taps, drills, and other tools.

The essential feature of the method is the use as a guide in the steel-treating process of a change in rate of heating of a neutral body at the time the transformation in the steel occurs. This eliminates several of the variable conditions present in other methods of treatment, and permits more thorough study of the problem of hardening. In this way repetition of the same hardening conditions is possible, thus obtaining uniform results.

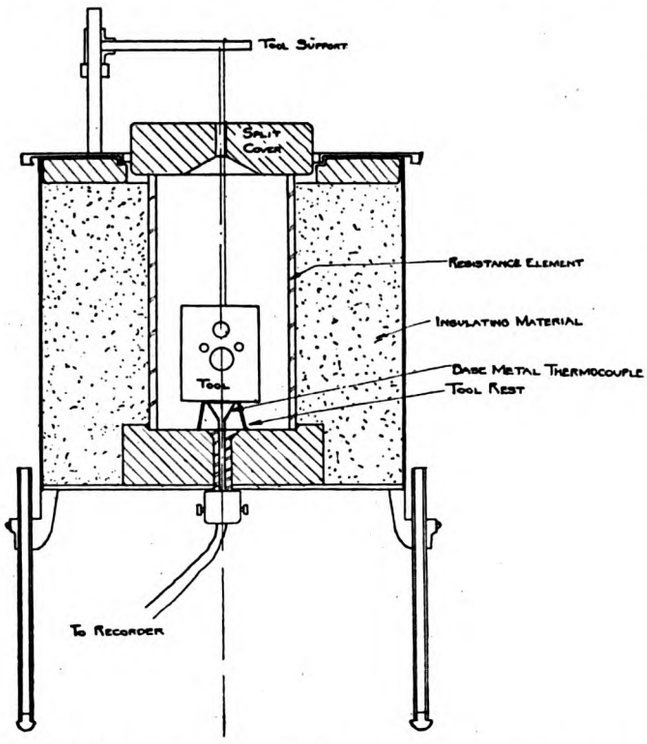

FIG. 1. SKETCH OF FURNACE, SHOWING METHOD OF SUSPENSION OF TOOL TO BE TREATED

Consider first the method as applied to the hardening of a punch and die of plain carbon tool-steel, bearing in mind that the same method can be applied to nearly all heat-treating problems. To obtain the best results, the tool is heated in an electric furnace such as is shown in Fig. 1. The resistive-unit is embedded in the walls of the furnace and it is wound so as to obtain a uniform temperature within reasonable commercial limits from the bottom to the top. The tool is suspended so that it rests upon or is close to a thermo-couple as shown in Fig. 1. A practically neutral atmosphere is maintained. For quantity production, the parts are placed on holders so that the work surrounds the thermo-couple. The rate of heating of the furnace is controlled by a rheostat connected in series with the furnace-winding.

The thermo-couple is connected to a curve-drawing potentiometer-recorder, which gives a graphic record of the temperature of the hot-junction of the thermo-couple but not the temperature of the work at all times. A sample record, showing the temperature during the hardening of a blanking-die, is shown in Fig. 2. Before the work is placed in the furnace, the temperature of the latter is brought to about 1400°F., as indicated by the thermo-couple and as shown at point *A* on the temperature curve (Fig. 2). The tool is then suspended in the furnace, the cover replaced and the control-switch opened. This cuts off the energy input to the furnace, and the temperature of the tool rises to that of the furnace. In the meantime the temperature of the furnace-walls will decrease, as shown in the right-hand part of the dotted curve. The thermo-couple temperature, as shown by the solid curve, drops rather suddenly at first but soon regains some of its heat with the rise in temperature of the tool, which latter is indicated by the left-hand part of the dotted curve. After a sufficient length of time has elapsed, all these bodies, furnace-walls, thermo-couple, and tool, reach approximately the same temperature, as shown at *B*.

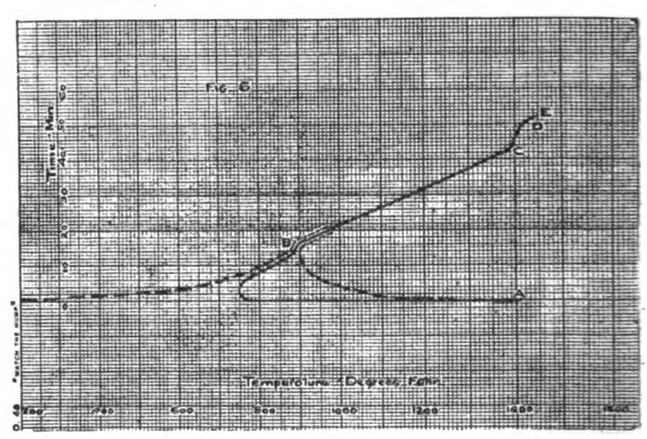

FIG. 2. TEMPERATURE-CURVES

This means that the tool has reached a uniform temperature throughout. The energy is than turned on again and the current adjusted by means of the rheostate so as to increase the temperature of the tool at the desired rate. If the proper rate of temperature rise has been chosen there will be no large temperature difference within the body of the tool at any time, and when the steel reaches its decalescence point, all sections of the tool will be at the same temperature. At this point

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there is the usual halt in the rise of temperature of the steel ,that always accompanies this change. Consequently the increase in temperature of the thermocouple is indicated by the abrupt change in the slope of the curve at *C*. When the transformation is complete there is another change in the rate of heating, as shown by *D*. The temperature of the tool is then allowed to increase for a sufficient time beyond this point to ensure hardness and quenched at the point *E*. The time allowed above the 'hump' depends upon the nature of the quenching medium as well as the mass and shape of the tool as is the case in any method of hardening.

The 'hump' on the curve is used as a reference point and by its use we control a number of the variables which occur in present methods of heating.

In order to heat treat properly a punch or die we must control the following variable conditions:

1. The amount of increase in temperature of the tool above its decalescence or critical point before quenching. A variation in this quenching-point will cause the tool to be soft when it is removed from the quenching medium,

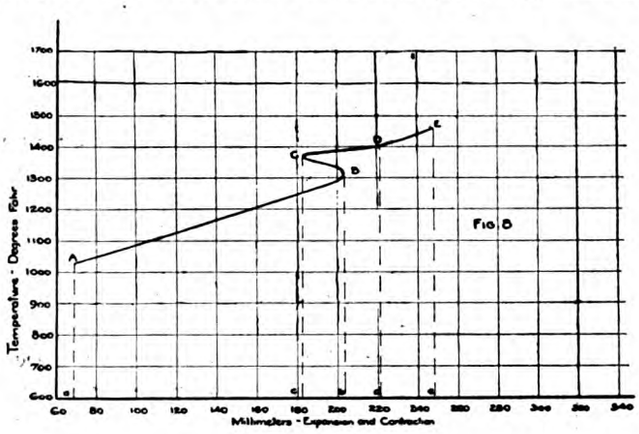

FIG. 3. EXPANSION--CURVE

or will cause an abnormal growth of grain size, making the tool weak and very poor as regards its physical properties.

2. The rate of heating of the tool. Heating too fast causes breakage, deformation, or sets up stresses from which will follow an early failure in service. Too slow heating has been found to cause a volume change in the steel, which produces an appreciable increase in the cost of finishing the tool.

3. The atmosphere in which the tool is heated. An oxidizing atmosphere means a decarbonized surface, which decreases the efficiency of the tool enormously.

4. The quenching conditions. These, from present knowledge, seem to be more under our control than the heating conditions.

The use of the electrical furnace and the hump method of heat treatment provides us with a means of controlling these variables and enables us to repeat or change the heating conditions at will. We do not depend upon the accuracy of the pyrometer because we harden from the time of the transformation.

By the use of the hump method we quench the steel at the proper temperature as measured from the critical point of the tool itself, and not of a sample of the steel. This enables us to control the grain size and physical properties and to repeat the results at any time. The uniformity of heating and control of the rate of heating enables us to eliminate the breakage, distortion, and volume-change which is present where we have no control over these conditions.

The vertical type of furnace is superior to the horizontal type for most work. The tool resting upon a hearth of a horizontal furnace is in all probability supported only at a few points and may warp in the heating.

The following discussion of the control of the volume-change in steel is substantiated by few facts to date, but it is presented as a theory which is supported by circumstantial evidence at least.

Several authorities agree that the total expansion-temperature curve of a tool-steel appears as in Fig. 3. To the beginning of the decalescence at *A*, the expansion is proportional to the temperature, and, as this temperature is determined by the chemical analysis of the steel, the total expansion *ab* is a constant for any given steel. The expansion *de* also is proportional to the temperature and when the quenching temperature has been determined by the best physical properties this expansion also becomes a constant. We will assume that there is a total contraction of *ef* which takes place in the quench depending upon the temperature of the steel at the point *D* and the quenching medium. This would also become a constant value for a particular kind of steel.

During the transformation there is an expansion as well as a contraction of the metal, the amount of both apparently depending upon the rate of heating. It is then necessary to determine the rate of heating which will make *ac* and *cd* of such values that we obtain the equation

$$ab + bd + de = cd + ef$$

in order to obtain no volume-change whatever.

Acting upon this theory, Mr. Tall has been able to reduce the change of dimensions in tools to less than 0.001 in. In the discussion following the reading of the paper, one member mentioned a particular job that his concern handled, namely, making sleeves 14 in. long, 3 in. outside diameter, and 2½ in. inside diameter, with a thread on the inside on one end that had to be held to shape within 0.008 in. The sleeve is made of low-carbon chrome-nickel steel, case-carbonized to a depth of 3/32 in., and is quenched in oil. Satisfactory results have been obtained using the hump method, which could not be accomplished by any other.

AN English vicar and his curate had quarreled and the latter was requested to find some other congregation. The curate therefore preached his farewell sermon and the parishioners came in crowds to hear him. "My text," he said, "is taken from the moving story of Abraham, 'Tarry ye here with the ass, while I * * * go yonder'." —'Boston Transcript.'

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Definitions of Export Quotations

General recommendations for a standard American export practice were adopted as follows at a conference held at New York and attended by representatives of various organizations interested in both domestic and foreign trade.

As the most certain means of ensuring unmistakable clarity in terms and conditions of sale, the conference voted to recommend to manufacturers and exporters that all use of abbreviated forms of export-price quotations be abandoned, and that such terms be written in full.

The conference recognized, however, that this recommendation is not likely to be accepted generally at once; and therefore, in the hope of effecting a simplification and standardization of American practice, it adopted the following statement of definitions of the abbreviated forms in more common and general use in the export trade. The conference strongly recommends to manufacturers and exporters that, whenever abbreviated forms of export quotations are employed, the forms herein defined be used, as far as possible, to the exclusion of other forms.

These are, in their order, the normal situations on which an export manufacturer or shipper may desire to quote prices. It is understood that unless a particular railroad is specified, the property will be delivered to the carrier most conveniently located to the shipper. If the buyer, for the purpose of delivery, or in order to obtain lower transportation-charges, desires that the goods be delivered to a carrier farther removed from the shipper and entailing a greater cost than delivery to the carrier most favorably situated, the carrier to which the buyer desires delivery of the goods should be named in the quotation. The term 'cars or lighters', as used herein, is intended to include river, lake, or coastwise ships, canal-boats, barges, or other means of transportation, when so specified in the quotation.

1. When the price quoted applies only at inland shipping-point and the seller merely undertakes to load the goods on or in cars or lighters furnished by the railroad company serving the industry, or most conveniently situated to the industry, without other designation as to routing, the proper term is: 'f.o.b. (named point)'. Under this quotation:

(*a*) Seller must (1) place goods on or in cars or lighters, (2) secure railroad bill of lading, (3) be responsible for loss and (or) damage until goods have been placed in or on cars or lighters at forwarding-point, and clean bill of lading has been furnished by the railroad company.

(*b*) Buyer must (1) be responsible for loss and (or) damage incurred thereafter, (2) pay all transportation charges, including taxes, if any, (3) handle all subsequent movement of the goods.

2. When the seller quotes a price including transportation charges to the port of exportation without assuming responsibility for the goods after obtaining a clean bill of lading at point of origin, the proper term is: 'f.o.b. (named point) freight prepaid to (named point on the seaboard)'. Under this quotation:

(*a*) Seller must (1) place goods on or in cars or lighters, (2) secure railroad bill of lading, (3) pay freight to named port, (4) be responsible for loss and (or) damage until goods have been placed in or on cars or lighters at forwarding-point, and clean bill of lading has been furnished by the railroad company.

(*b*) Buyer must (1) be responsible for loss and (or) damage incurred thereafter, (2) handle all subsequent movement of the goods, (3) unload goods from cars, (4) transport goods to vessels, (5) pay all demurrage and (or) storage charges, (6) arrange for storage in warehouse or on wharf where necessary.

3. Where the seller wishes to quote a price, from which the buyer may deduct the cost of transportation to a given point on the seaboard, without the seller assuming responsibility for the goods after obtaining a clean bill of lading at point of origin, the proper term is: 'f.o.b. (named point) freight allowed to (named point on the seaboard)'. Under this quotation:

(*a*) Seller must (1) place goods on or in cars or lighters, (2) secure railroad bill of lading, (3) be responsible for loss and (or) damage until goods have been placed in or on cars or lighters at forwarding-point, and clean bill of lading has been furnished by the railroad company.

(*b*) Buyer must (1) be responsible for loss and (or) damage incurred thereafter, (2) pay all transportation charges (buyer is then entitled to deduct from the amount of the invoice the freight paid from primary point to named port), (3) handle all subsequent movement of the goods, (4) unload goods from cars, (5) transport goods to vessel, (6) pay all demurrage and (or) storage charges, (7) arrange for storage in warehouse or on wharf where necessary.

4. The seller may desire to quote a price covering the transportation of the goods to seaboard, assuming responsibility for loss and (or) damage up to that point. In this case, the proper term is: 'f.o.b. cars (naming point on seaboard)'. Under this quotation:

(*a*) Seller must (1) place goods on or in cars, (2) secure railroad bill of lading, (3) pay all freight charges from forwarding point to port on seaboard, (4) be responsible for loss and (or) damage until goods have arrived in or on cars at the named port.

(*b*) Buyer must (1) be responsible for loss and (or) damage incurred thereafter, (2) unload goods from cars, (3) handle all subsequent movement of the goods, (4) transport goods to vessel, (5) pay all demurrage and

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(or) storage charges, (6) arrange for storage in warehouse or on wharf where necessary.

5. It may be that the goods, on which a price is quoted covering the transportation of the goods to the seaboard, constitute less than a carload lot. In this case, the proper term is: 'f.o.b: cars (named port) l.c.l.' Under this quotation:

(*a*) Seller must (1) deliver goods to the initial carrier, (2) secure railroad bill of lading, (3) pay all freight charges from forwarding-point to port on seaboard, (4) be responsible for loss and (or) damage until goods have arrived on cars at the named port.

(*b*) Buyer must (1) be responsible for loss and (or) damage incurred thereafter, (2) handle all subsequent movement of the goods, (3) accept goods from the carrier, (4) transport goods to vessel, (5) pay all storage charges, (6) arrange for storage in warehouse or on wharf where necessary.

6. Seller may quote a price which will include expense of transportation of the goods by rail to the seaboard, including lighterage. In this case the proper term is: 'f.o.b. cars (named port) lighterage free'. Under this quotation:

(*a*) Seller must (1) place goods on or in cars, (2) secure railroad bill of lading, (3) pay all transportation charges to, including lighterage at, the port named, (4) be responsible for loss and (or) damage until goods have arrived on cars at the named port.

(*b*) Buyer must (1) be responsible for loss and (or) damage incurred thereafter, (2) handling all subsequent movement of the goods, (3) take out the insurance necessary to the safety of the goods after arrival on the cars, (4) pay the cost of hoisting goods into vessel where weight of goods is too great for ship's tackle, (5) pay all demurrage and other charges, except lighterage charges.

7. The seller may desire to quote a price covering delivery of the goods alongside overseas vessel and within reach of its loading-tackle. In this case the proper term is: 'f.a.s. vessel (named port)'. Under this quotation:

(*a*) Seller must (1) transport goods to seaboard, (2) store goods in warehouse or on wharf if necessary, unless buyer's obligation includes provision of shipping facilities, (3) place goods alongside vessel either in a lighter or on the wharf, (4) be responsible for loss and (or) damage until goods have been delivered alongside the ship or on wharf.

(*b*) Buyer must (1) be responsible for loss and (or) damage thereafter, and for insurance, (2) handle all subsequent movement of the goods, (3) pay cost of hoisting goods into vessel where weight of goods is too great for ship's tackle.

8. The seller may desire to quote a price covering all expenses up to and including delivery of the goods upon the overseas vessel at a named port. In this case the proper term is: 'f.o.b. vessel (named port)'. Under this quotation:

(*a*) Seller must (1) meet all charges incurred in placing goods actually on board the vessel, (2) be responsible for all loss and (or) damage until goods have been placed on board the vessel.

(*b*) Buyer must (1) be responsible for loss and (or) damage thereafter, (2) handle all subsequent movement of the goods.

9. The seller may be ready to go further than the delivery of his goods upon the overseas vessels and be willing to pay transportation to a foreign point of delivery. In this case the proper term is: 'c.&f. (named foreign port)'. Under this quotation:

(*a*) Seller must (1) make freight contract and pay transportation charges sufficient to carry goods to agreed destination, (2) deliver to buyer or his agent proper bills of lading to the agreed destination, (3) be responsible for loss and (or) damage until goods have been delivered alongside the ship and clean ocean bill of lading obtained (seller is not responsible for delivery of goods at destination).

(*b*) Buyer must (1) be responsible for loss and (or) damage thereafter and must take out all necessary insurance, (2) handle all subsequent movement of the goods, (3) take delivery and pay costs of discharge, lighterage, and landing at foreign port of destination in accordance with bill of lading clauses, (4) pay foreign customs-duties and wharfage charges, if any.

10. The seller may desire to quote a price covering the cost of the goods, the marine insurance on the goods, and all transportation charges to the foreign point of delivery. In this case, the proper term is: 'c.i.f. (named foreign port)'. Under this quotation:

(*a*) Seller must (1) make freight contract and pay freight charges sufficient to carry goods to agreed destination, (2) take out and pay for necessary marine insurance, (3) be responsible for loss and (or) damage until goods have been delivered alongside the ship, and clean ocean bill of lading and insurance policy have been delivered to the buyer or his agent. (Seller is not responsible for the delivery of goods at destination, nor for payment by the underwriters of insurance claims), (4) provide war-risk insurance where necessary for buyer's account.

(*b*) Buyer must (1) be responsible for loss and (or) damage thereafter, and must make all claims to which he may be entitled under the insurance directly to the underwriters, (2) take delivery and pay costs of discharge, lighterage, and landing at foreign ports of destination in accordance with bill of lading clauses, (3) pay foreign customs-duties and wharfage-charges, if any. Explanations of abbreviations are given below:

F. O. B.	Free on board
F. A. S.	Free alongside ship
C. & F.	Cost and freight
C. I. F.	Cost, insurance, and freight
L. C. L.	Less than carload lot

In reaching the conslusions set forth in this statement the conference considered the fact that there are, in more or less common use by manufacturers in different parts of the United States, numerous variations of these abbreviations, practically all of which are employed to convey meaning substantially synonymous with those

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here defined. For instance, there are manufacturers who quote 'f.o.b. cars', 'f.o.b. works', 'f.o.b. mills', or 'f.o.b. factory', meaning that the seller and buyer have the same responsibilities as those set forth in section No. 1. The conference considered all those variations and determined to recommend the use of 'f.o.b. (named point)', as 'f.o.b. Detroit', 'f.o.b. Pittsburgh', etc. Of the considerable number of these abbreviations which are used in the United States, the conference felt that the form 'f.o.b. (named point)' is most widely used and understood, and, therefore, should be adopted as the standard of practice. The chief purpose of the conference is to simplify and standardize American practice, and to that end it urges manufacturers and exporters to cease the use of synonymous abbreviations and quote habitually in the terms here recommended, just as far as these terms will cover the price conditions that it is desired to arrange with the buyer.

Variations of the abbreviations recommended in other sections also are in more or less common use throughout the United States. The recommendations of the conference set forth above apply to them with the same force as to those cited under section No. 1.

Manufacturers and exporters are urged to bear in mind that the confusion and controversies which have arisen have sprung in part from the use of an excessive number of abbreviated forms with substantially similar meanings, as well as from the use of abbreviations in a sense different from their original meanings, or in an application not originally given them and different from the sense or application understood by foreign buyers. In simplified and standardized practice lies the best hope of reducing confusion and avoiding controversy.

The conference urges upon manufacturers and exporters the very great importance at all times of making their intention in whatever quotations they employ so clear as to be impossible of misunderstanding or misinterpretation. It is much better to take the time and space at the outset to make the quotation clearly understood, than to be compelled in the end to go through vexatious controversy or litigation, which costs not only time and expense but customers as well. Misunderstandings can best be avoided if the seller will formulate a written statement of the general conditions under which his sales are to be made, and will see that the foreign buyer possesses these terms of sale when considering a quotation. The items which may be included in such a statement, deal with delivery, delays, partial shipments, shipping instructions, inspection, claims, damage, and payment. If all contingencies are thus covered by carefully considered conditions of sale, disputes will largely be prevented.

The quotation 'f.o.b. (named port)', as 'f.o.b. New York', 'f.o.b. New Orleans', 'f.o.b. San Francisco', is often used by inland producers and distributers to mean merely delivery of the goods at railway terminal at the port named. This abbreviation originated as an export quotation and had no application to inland shipments. It was used only to mean delivery of the goods upon an overseas vessel at the port named. That, in fact, is the meaning universally given to the phrase among foreigners, and is the meaning which the best practice among exporters requires it invariably to have. But because of the confusion which has arisen through the use of that form with a different meaning by inland producers and distributors, and in the interest of clarity, the conference urges the invariable use by American manufacturers and exporters of the form 'f.o.b. (named port)'. This adds only one word to the abbreviated form and has the great advantage that it cannot be misunderstood. It also avoids the difficulty which might arise among foreigners not always well versed in American geography, through confusing an inland forwarding point with a shipping port at seaboard.

The conference calls attention to the fact that in selling 'f.a.s. vessel', manufacturers and exporters should be careful to have their agreements with buyers cover explicitly the question of responsibility for loss after goods have been delivered on the wharf alongside the vessel and before they are actually loaded on the ship. There is no generally established practice on this point. The recommendation of the conference in the definitions of responsibility under section No. 7, sets up a rule which it is hoped will lead to the establishment of a standard practice. It is understood that the provision of lighterage covered in several of these recommendations is only within the usual free-lighterage limits of the port, and that where lighterage outside such limits is required, it is for buyer's account.

In order to avoid confusion in another particular, attention is called to the care which must be exercised in all cases in making weight quotations. The net ton, the gross ton, and the metric ton all differ in weight. Similarly there is a variation in the use of the term 'hundredweight' to mean either 100 lb. or 112 lb. It is, therefore, not sufficient to quote a price per 'ton' or per 'hundredweight'. Instead the conference recommends the use of the terms 'ton of 2000 lb', 'ton of 2240 lb.', or 'ton of 2204 lb.', etc., whichever is intended.

It is also important to note that a carload-lot in the United States means the quantity of the particular commodity in question necessary to obtain the carload freight-rate for transportation on American railways. This quantity varies according to the commodity and also varies in different parts of the country. Certain commodities being more bulky than others, the minimum carload for them is less than for heavier products occupying less space. The load required may range anywhere from 12,000 to 90,000 lb. Consequently, it is important, when quoting prices applicable to carload-lots, to so state and to specify the minimum weight necessary to make a carload-lot of the particular commodity for the particular shipment in question.

The conference points out that in quoting 'c.&f.' or 'c.i.f.', manufacturers and exporters moving large quantities of material by one vessel should be careful to ascertain in advance the buyer's capacity to take delivery. This is because, under these terms as a condition of

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making the freight-rate, transportation companies may require a certain rate of discharge per day, and that rate of discharge might be in excess of the buyer's capacity to take delivery. In such event an adjustment with the transportation company would be necessary, which might affect the freight-rate and consequently the price to be quoted.

The conference also strongly urges shippers clearly to understand the provisions of their insurance protection on all foreign sales, irrespective of the general terms used thereon. In almost all cases it should be possible, when making shipments by steamer, to obtain insurance-cover giving full protection from primary shipping-point to designated sea-port delivery, and (or) foreign port delivery. As ordinary marine insurance under f.p.a. conditions, namely, free of particular average, gives no protection against deterioration and (or) damage to the merchandise itself while in transit, when caused by the recognized hazards attending such risks, shippers should endeavor in all cases to obtain insurance under w.p.a. (s.p.a.) conditions, namely, with particular average (subject to particular average), when in excess of the customary franchise of 3% to 5%. Under such form of insurance, underwriters will be called upon to pay claims for damages when these exceed the stipulated franchise.

The conference points out that, inasmuch as fees for consular invoices and similar items are arbitrary charges fixed by foreign governments, they are not included in the terms of c.&f. or c.i.f. quotations, and it is part of the duty of the buyer to meet them.

Finally, the conference strongly recommends, as a most effective measure of simplification, the general practice of quoting for export, as far as possible, either 'f.a.s. vessel', 'f.o.b. vessel', or 'c.i.f.' Concentration on this small list, all of which terms are readily understood abroad and are difficult of misinterpretation, will, it is felt, be markedly influential in avoiding confusion and controversy.

American Engineering Standards Committee to Prepare Safety Codes

As a result of a number of conferences of representatives from interested organizations, held under the auspices of the U. S. Bureau of Standards it was decided that a Joint Committee on Safety Codes be organized to have charge of the preparation of safety codes dealing with all branches of industry. This work is to be done under the auspices of the American Engineering Standards Committee. It is estimated that between 50 and 100 safety codes should be developed during the next few years. The Joint Committee is to be composed of representatives from the Bureau of Standards, the National Safety Council, the International Association of Industrial Accident Boards and Commissions, together with such other organizations as may be deemed advisable.

A New Use for the Standard Electric Resistance-Furnace*

The generally accepted practice in the steel industry for the introduction of manganese, is to charge this material into the ladle in the molten condition, since there are material advantages to be gained by the process. However, placing the manganese alloy in the molten condition has resulted in an unduly high loss, as manganese has a relatively low volatilization temperature and oxidizes readily, either in the 70% alloy, or in spiegeleisen. The arc-type electric furnace for this purpose is almost as objectionable as the fuel-fired type, on account of the difficulty in keeping the furnace tightly closed around the electrodes and the doors. Besides, the high-temperature arc, as with non-ferrous alloys containing zinc, produces an unduly high loss of metal because of volatilization.

The melting-point of ferro-manganese and spiegeleisen requires only little higher furnace operating-temperature than when melting standard brass mixtures, so that the advantages of the resistance-type furnace for melting brass apply with equal force when melting ferro-manganese is considered.

Another advantage of this type of furnace is that it can be built with a relatively large hearth compared with its melting capacity, and the charge of molten ferro-manganese can be held in the furnace for long periods without material loss of the alloy, thus making the furnace substantially a hot storage for the molten ferro-manganese, and at the same time keeping the current on the furnace at a given amount, producing a desirable electrical load as compared with the arc-furnace, and providing in a typical installation sufficient storage of hot metal, so that if several furnace-heats should come at one time from the open-hearth or electric furnace, requiring molten ferro-manganese substantially at the same time, the hot metal would be available immediately, and the melting rate for the 24-hour period would be constant.

Not long ago a lady was giving a lecture. Her subject was the human figure, and the requirements in the way of proportion for beauty.

She herself was of generous size, and her manner was lofty.

She was trying to demonstrate the relative sizes of the limbs as they really ought to be.

"For example," said she, "twice round my thumb (she held it up) once round my wrist; twice round my wrist, once round my neck; twice round my neck, once round my waist." Then she paused, and a shrill voice from the audience exclaimed:

"Twice round your waist, once round Hyde Park."

The lecturer hastily passed on to another branch of the subject.—London Ideas.

*From 'The Electric Furnace'.

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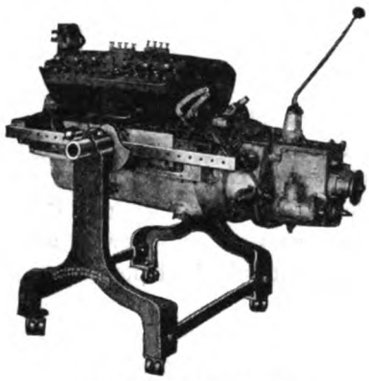
INDUSTRIAL EQUIPMENT

THE CANEDY-OTTO MOTOR-STAND

To meet the demand for a serviceable stand to use when repairing automotive motors and transmissions, the Canedy-Otto Manufacturing Co., of Chicago Heights, Illinois, has developed the motor-stand shown in the accompanying illustration. It is designed to handle all kinds of automobile,

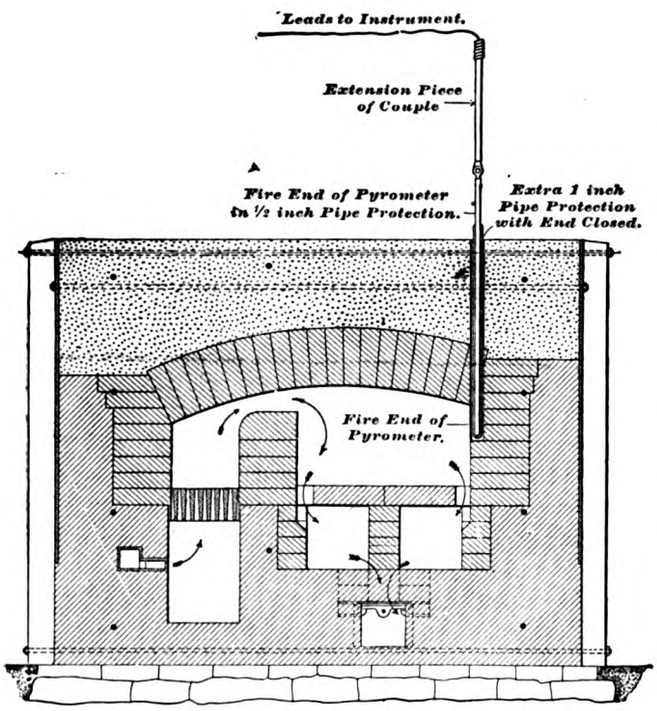


The Canedy-Otto Stand

truck, and tractor motors of both the three and four-point suspension types. The motor can be turned in any desired position in a circle and locked in that position by a single turn of a friction-clamp. Adjustments required to take care of the various sizes of motors can all be made by shifting the friction-heads. The stand may be wheeled on its casters to any part of the shop, or the casters may be removed if the mechanic wants a stationary stand or wishes to bolt it to the floor.

ARRANGEMENT OF PYROMETER FOR USE WITH AN ANNEALING-FURNACE

The accompanying sketch shows the method recommended for installing a Bristol pyrometer for use with a Brown & Sharpe type annealing-furnace. This arrangement will



Pyrometer Arrangement

give the closest approximation to the actual temperature of the steel to be treated rather than merely that of the hot gases. Tests have shown that the temperature of the steel frequently increases even after the heat has been shut off and the temperature of the furnace-gases has begun to fall.

THE DFC. LOW-PRESSURE OIL-BURNER

In the DFC burner, shown in the accompanying illustration and manufactured by the Denver Fire Clay Co., of Denver, a central channel is provided through which the oil flows. The oil is discharged through an enlarged orifice in

The DFC Oil-Burner

a thin circular film, which is caught by a rotating blast of air and thrown from the nozzle as a fine whirling mist. Air for combustion is supplied at 6 to 14 oz. pressure, and this is controlled by a regulating adjustment on the side of the burner. The air is supplied by a DFC blower connected with a motor of special design operating at 3600 r.p.m. The power consumption is much smaller than that of the ordinary type of burner.

THE RADBORE DRILLING ATTACHMENT

One of the most efficient of the devices developed for drilling square holes is the Radbore drilling attachment manufactured by the Fairbanks Co., of New York. The principle upon which it operates is illustrated in Fig. 1. The sketch at the right shows the cross-section of the shank

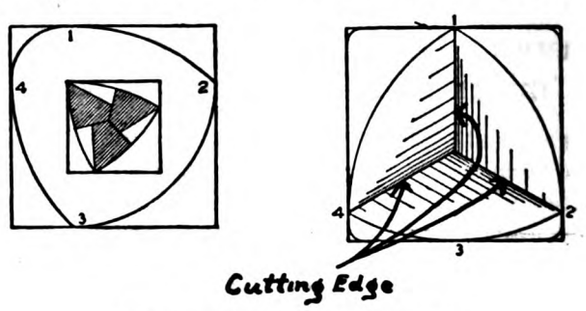


Fig. 1. Sketch of Radbore Attachment

of a drill, which is rotated inside a square guide as shown by the outside lines. If cutting-edges are ground on the end of the drill as indicated in the sketch, they will sweep across the surface of a square with rounded corners. Hence, if the drill is fed into the material, it will cut out a square hole with filleted corners. To make a square hole with sharp corners, a shank as indicated by 1-2-3-4 in the sketch at the left of Fig. 1 is used. One cutting-edge is longer than the rest, and this goes into the corners to square them. The

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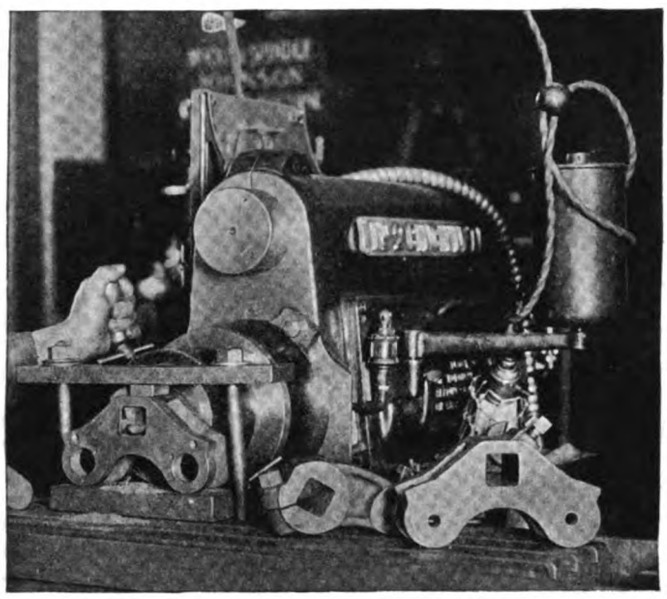
Radbore attachments drill square holes from ⅛ in. to 2 in. in any metal in one operation without previous preparation and without subsequent finishing. They are adaptable to milling-machines or to vertical and horizontal drilling-machines. The drills have a positive drill from the spindle of



Drilling Square Holes with Rounded Corners on Milling-Machine Equipped with Radbore Attachment

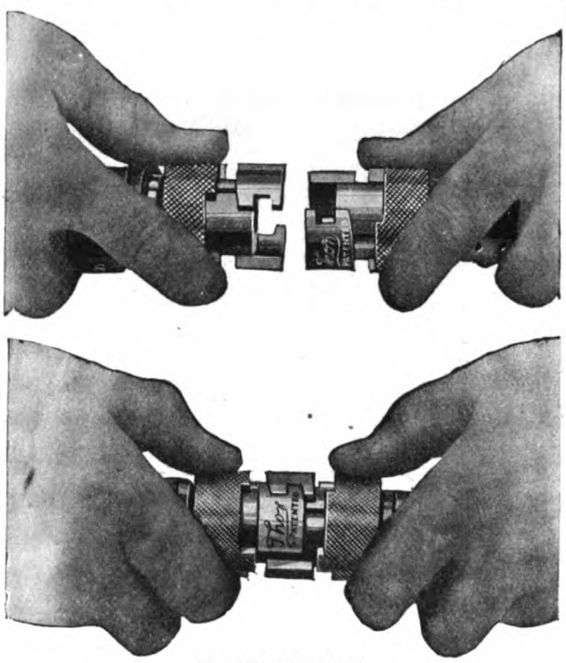
the machine and the cutting lips follow a path determined by the adjustable jaws of the head, so that no preliminary round hole is necessary. The drills are manufactured in two styles, one for making square holes with filleted corners, the fillet being ⅛ of the drill size, and the other for making square holes with square corners.

THE GARDNER TURBINE MUFFLER

Many automobilists have found that the use of the Gardner turbine muffler, which is manufactured by the Turbine Muffler Manufacturing Co., of San Francisco, is giving increased efficiency and mileage per gallon of gasoline. The device has a by-pass, which is connected to the conduit and to the centre of the fan-casing. The exhaust strikes the fan on the outer rim, runs it at high speed, and forms a strong suction through the by-pass. As a centrifugal fan cannot draw from the outer rim, the gases going through the by-pass are thrown out of the short end and into the expansion-chamber. The effect is to reduce carbon, keep the engine from overheating, and to save water, oil, and gasoline.

THE THOR HOSE-COUPLING

A new and efficient coupling for air-hose has been designed by the Independent Pneumatic Tool Co. The method of connecting and disconnecting is shown in the accompanying illustrations. A straight pull on the knurled sliding

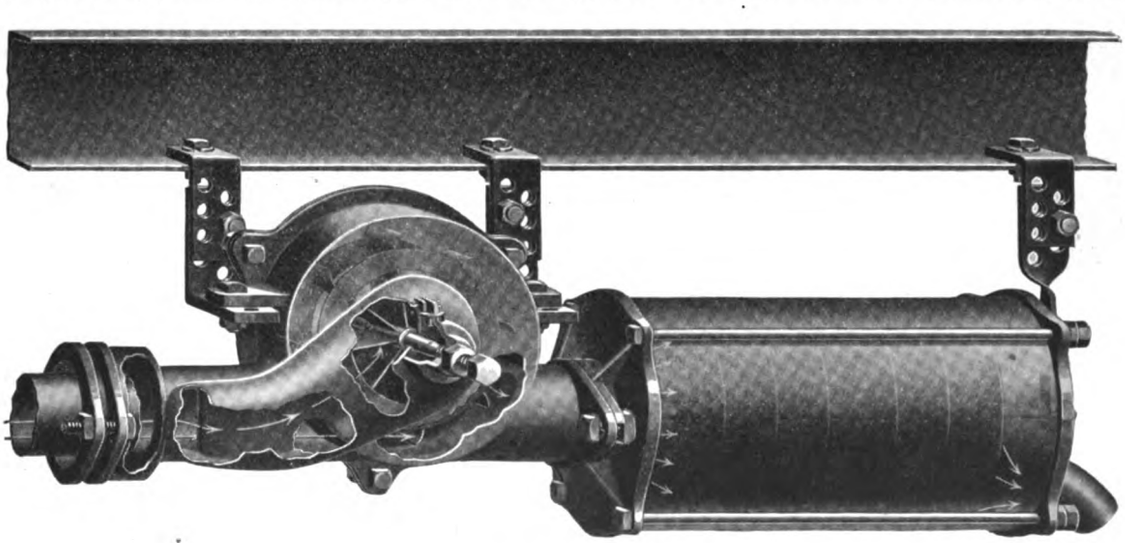


The Thor Coupling

sleeves disconnects the hose. It is not even necessary to twist it, as the bevel jaws separate as soon as the locking-shoulder moves back. Both jaws and shoulders are heavy and durable, as is the operating-spring but the latter can easily be replaced, if necessary, by removing the washer. The gasket is held in place by the air-pressure.

THE MUMFORD VIBRATOR MOLDING MACHINE

For quantity production from a given pattern or plate of patterns the Mumford Molding Machine Co., of Chicago, has



The Gardner Muffler

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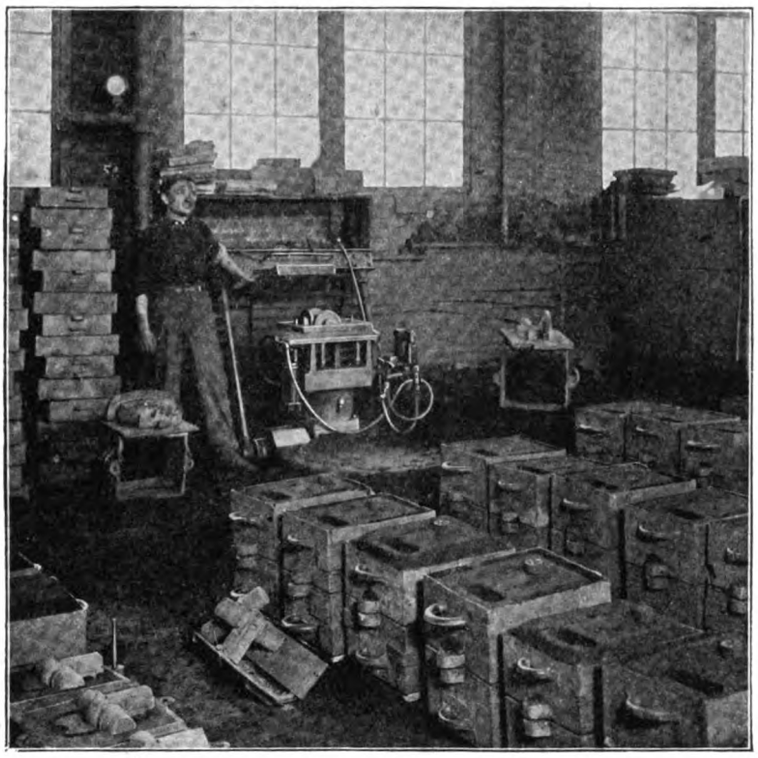
developed the split-pattern vibrator-machine shown in the accompanying illustration. It is specially designed for patterns split to a flat or nearly flat joint and fastened to a flat single-faced pattern-plate. It may be used with stripping-plate patterns by raising the pattern from the face of the pattern-plate a distance equal to the thickness of the stripping-plate, the stripping-plate lying loosely on the pattern-plate and projecting sufficiently to engage the flask-frame and the extra-long pins fitted on the flask-pin lugs. The flask-pins are withdrawn from the flask when the patterns are drawn from the sand. The machine may be furnished with a hand-starting pattern-draft, giving a slow hand-control start for the first ¼ inch and then automatically throwing in the power-draft. The molder does this with his right hand while operating the vibrator with his left. The machine may also be fitted with mechanism controlled by a knee-valve, and giving a smooth slow start for the first ¾ in. with a rapid finish, thus leaving the operator's hands free to pick up the mold as soon as the pattern is drawn. The frame settles to its original position during the time the mold is being carried to the floor.



The Mumford Molding Machine

FILMS TO BE PART OF U. S. TRADE EXPOSITION IN BUENOS AIRES

Industrial motion-pictures will play an important part in the National Exposition of United States Manufacturers to be held at Buenos Aires next November and in the similar exposition at Buenos Aires early in 1921. American manufacturers will not stop at exhibiting their products at the Exposition. They will supplement their display of wares upon South America's counter with films showing where and just how those wares are made.

Reports of American firms now using the motion-picture method of getting acquainted below the equator emphasize the value of industrial films in South America. Down there it is not merely a case of showing good samples and taking an order. Industrial films can show the factory conditions under which products of the United States are made.

No matter how good a sample looks, the South American merchant will want assurance that, if he creates a local market for a brand, he will be able to get future shipments of that product. South America is a long distance away and the reputations of many American manufacturers have not traveled that far yet. A film showing an enormous manufacturing plant will impress a South American with the stability of an American industry, will assure him that the firm will continue to be in business for some years to come, ready to fill future orders or supply parts of any machinery which he purchases.

And, frankly, display or show makes a tremendous impression upon the Latin temperament. A film visualizing the large buildings housing an American industry, scenes of the executive offices and of the factories in full action will fill a prospective South American customer with a profound respect for the concern that is after his order. South American merchants are prosperous and like to do business with prosperous people.

The Rothacker Film Manufacturing Co., of Chicago, was recently appointed official cinematographers of the Buenos Aires Exposition. The company stands ready to be of every possible service to manufacturers who plan to exhibit films in South America.

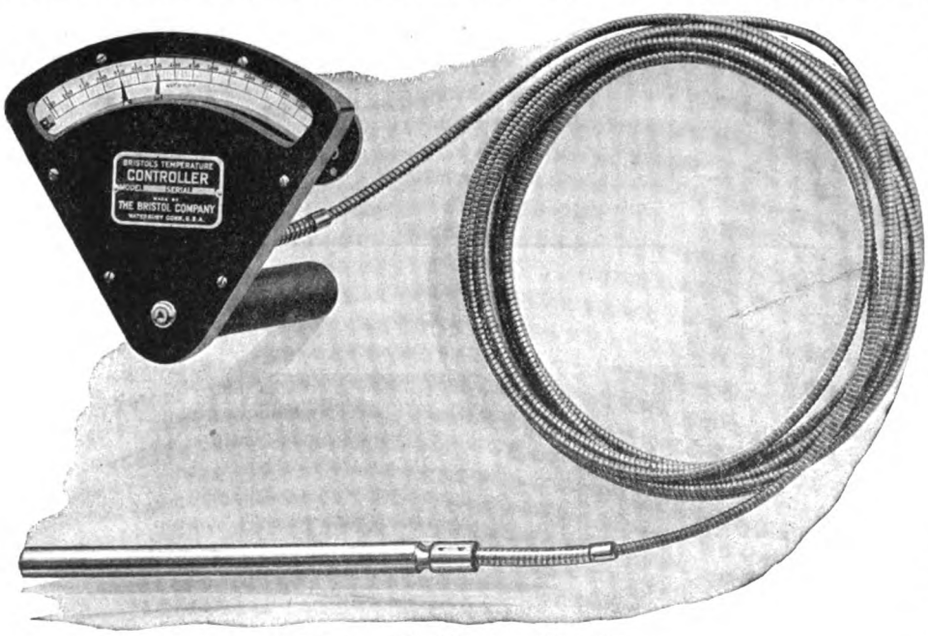


Fig. 1. Bristol Pyrometer-Controller

BRISTOL TEMPERATURE CONTROLLERS

For the automatic control of the temperature of various kinds of furnaces and drying-rooms, the Bristol Co. has developed pyrometer temperature controllers, working on the thermostat principle. Each thermo-

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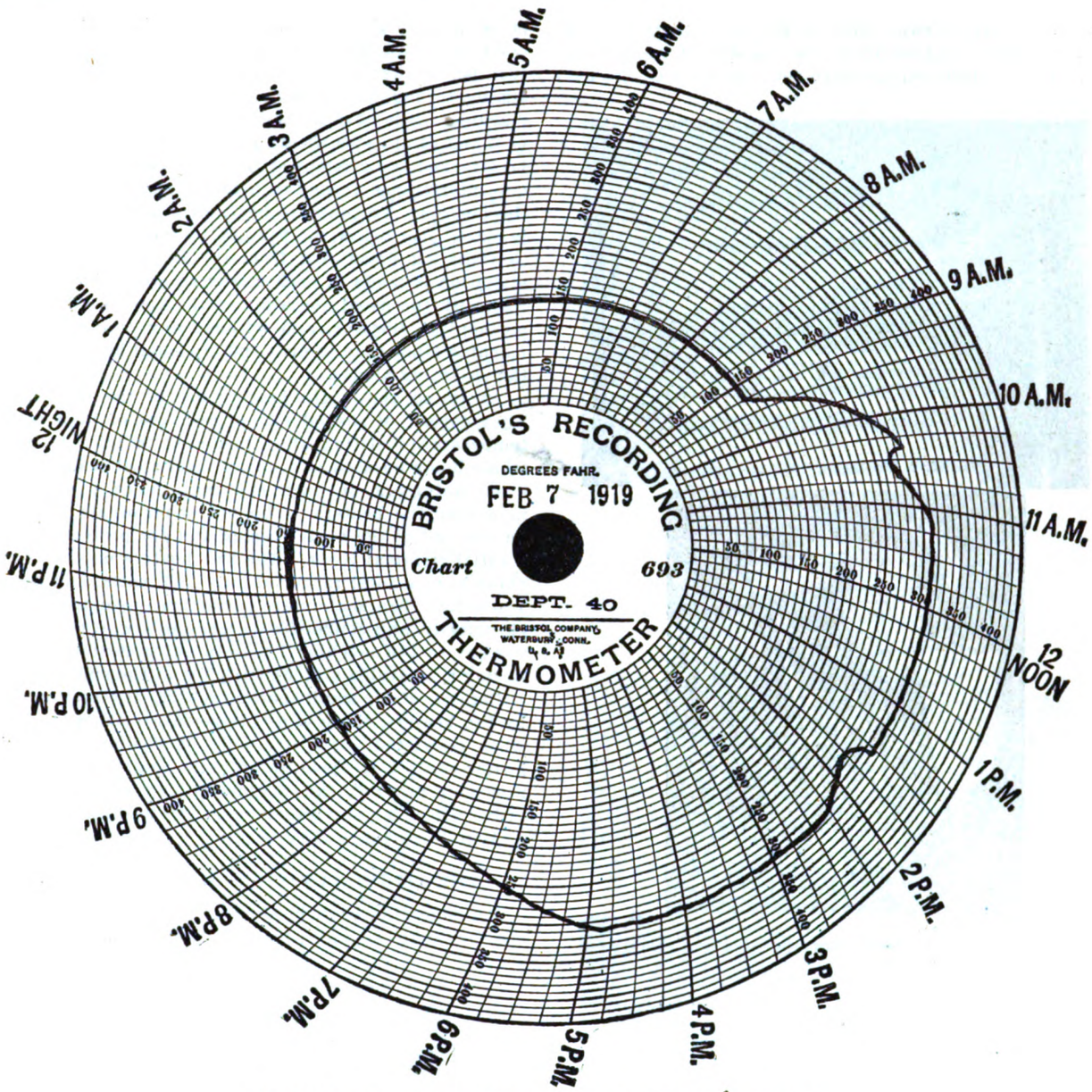

Fig. 2. Chart from Furnace Equipped with Bristol Temperature Controller

stat is equipped with an adjustable contactor, which may be adjusted to break contact at any point on the scale at which it is desired to regulate the temperature. As the temperature rises or falls the indicator-arm closes or opens the electrical circuit, which in turn controls the valves or switches, causing an increase or decrease in the heating medium. Furnaces or ovens heated by gas, oil, or electricity can be controlled with equal facility. The controls are designed for various ranges of temperature from minus 60° to plus 3000°F. Fig. 1 shows the type used for temperatures between 40° and 800°F. Fig. 2 shows a 24-hr. record of a gas-oven on which such a controller was used. Note the uniformity with which the temperature was maintained at 310°F. from 11 a.m. to 5 p.m. The two distinct drops at 10:20 a.m. and 1:35 p.m. show the time when batches of material were placed in the oven.

ELECTRICALLY-HEATED METAL PATTERN-PLATES ON MOLDING-MACHINES

By John M. Strait

The production of clean smooth castings from molds made with metal patterns depends upon there being no sticking of molding-sand to the patterns when they are removed from the sand. There is a tendency for moisture to collect on the cold metal pattern from the moist sand, or for the cold plate to 'sweat', during which process moisture collects on it. When this moisture collects, the sand sticks to the pattern being moved from the mold, and the mold acquires a rough surface, so that when the metal is poured, the casting will have a rough surface. This pattern will now have a rough surface due to the adhering sand, so that when the next mold is made, it will have a rough surface unless the pattern is cleaned and dried. This trouble is experienced summer and winter.

The collection of moisture can be prevented by heating the pattern. The heat applied, however, must not be so great as to cause the sand in the mold to dry, as it would then crumble away and again the casting would have a rough surface. Furthermore, the heat must be applied in such a way that the pattern can be conveniently changed when desired.

The usual method of heating is by means of a gas-flame left burning in the space underneath the pattern within the frame-work of the molding-machine. It is difficult to keep the flame low enough so that it will not heat the pattern

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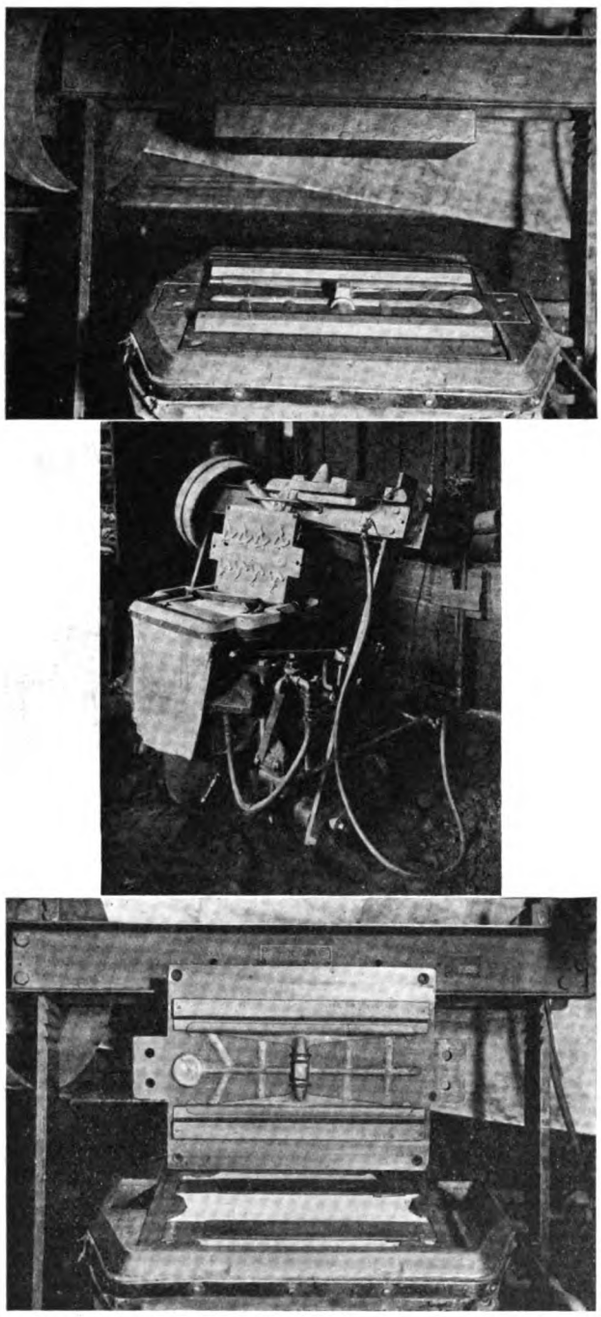
too much. A larger flame than necessary is, therefore, employed at some distance from the surface of application. This makes an inefficient arrangement, as most of the heat



Above, Machine with Pattern-Plate in Position. In the Centre, the Pattern-Plate Has Been Raised and Rests Against the Frame of the Machine, and One of the Heaters Is Raised Slightly to Show Construction. Below, the Pattern-Plate Has Been Raised to Show the Heater in Position.

is dissipated into the surrounding space. The surrounding air becomes contaminated by the gas fumes, and in summer there is the further discomfort from heating the room.

Difficulty is experienced due to variation of gas-pressure, so that at one time the pattern is too hot and at another too cold. When the pattern gets too hot, it is necessary to cut off the gas, and when it has cooled down, re-light and readjust the gas.

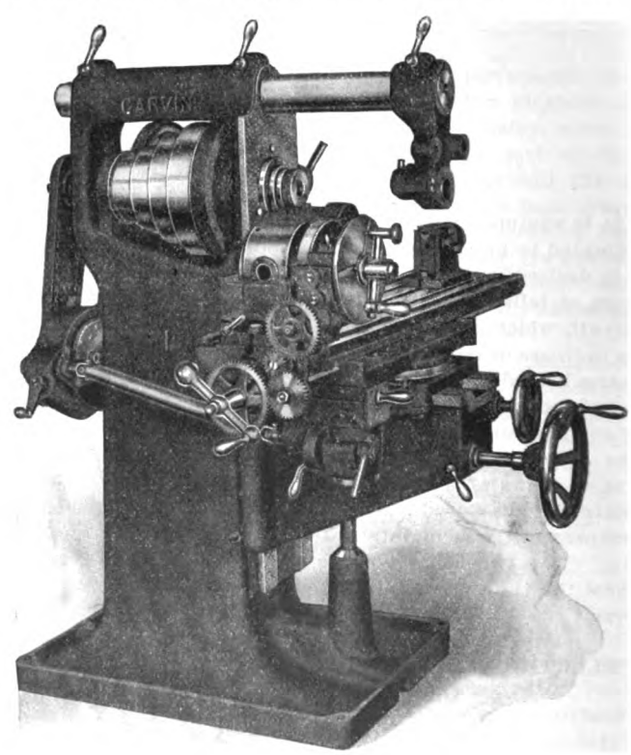
A much more convenient method of heating is by the use of electric heaters as shown in the photographs. Two steel-clad heaters are mounted in the space immediately below the metal pattern-plate, within the framework of the molding-machine. In order to use as little heat as possible they are just below the thickest pattern used. They are attached simply to supporting angles fastened to the frame of the machine. It is obvious, then, that any pattern of any thickness and of any size within the capacity of the machine may be attached to or removed from the molding-machine without interference from the heaters, and without disturbing the heaters. To conserve heat, an asbestos insulating-plate is placed just below the heaters, to prevent loss of heat due to radiation downward from the heaters. The entire installation is made in such a way as not to interfere in any way with the usual operation of the machine, including the mechanical vibrator, and without any modification of the machine other than to drill and tap small holes for attaching the mounting angles.

As stated above, the heaters are of the steel-clad type. They consist of slotted ribbon resistors of high resistance, temperature-resisting alloy insulated in mica troughs, the whole being encased in a heavy sheet-steel casing. There is a mounting-lug on each end with holes punched in for mounting the heaters. The heater-terminals are mounted on one end of the heater casing and are protected by a substantial terminal cover. The two heaters used on each machine have a total rating of only 300 watts, and operate at 110 volts. The heaters are permanently connected together electrically, and connection is made to a wall-receptacle convenient to the machine by means of a flexible heater-cord having a separable attachment-plug on the end.

Because of the small space in a vertical direction occupied by the heaters, there is ample room for them in the somewhat restricted space available; and due to the flexible heater-cord, it is possible for the pattern-support to be raised or lowered, the heaters moving as an integral part of it. These heaters are made by the Westinghouse Electric & Manufacturing Company.

THE GARVIN UNIVERSAL MILLING-MACHINE

For some time past the Garvin Machine Co. has recognized the fact that the inherent weakness of milling-machines is



The Garvin Milling-Machine

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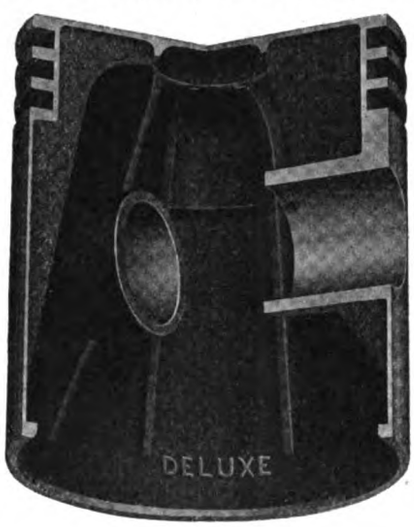
not so much in the spindle-fits and the net weight of the machine as in the knee, upon which rests the entire workings of the slide. For this reason the company has used its solid-top extended knee for several years. In the No. 1-BG universal milling-machine, shown in the accompanying illustration, a square lock and a taper gib have been added, eliminating all possibility of weakness of saddle-fit to knee, even under the heaviest cuts. A further improvement in this square-locked construction is the saddle-guide, which is placed centrally over the in-and-out screw. Among other notable features are the double-geared dividing head, the twelve-change feed-box, the bringing of the reverse of the trip-box to the front of the machine, and the interchangeable hand-wheels, which are not covered by the slide when milling right-hand spirals at 45°. The length of the automatic feed of the table is 22 in., the adjustment in line with the spindle is 8 in., and the vertical adjustment under the spindle is 22 in. The machine can be equipped for motor-drive.

CLARK-TURNER LIGHT-WEIGHT PISTONS

The piston shown in the accompanying illustration has been designed after considerable study by the Clark-Turner Piston Co. of Los Angeles, with the object of reducing



Light-Weight Piston

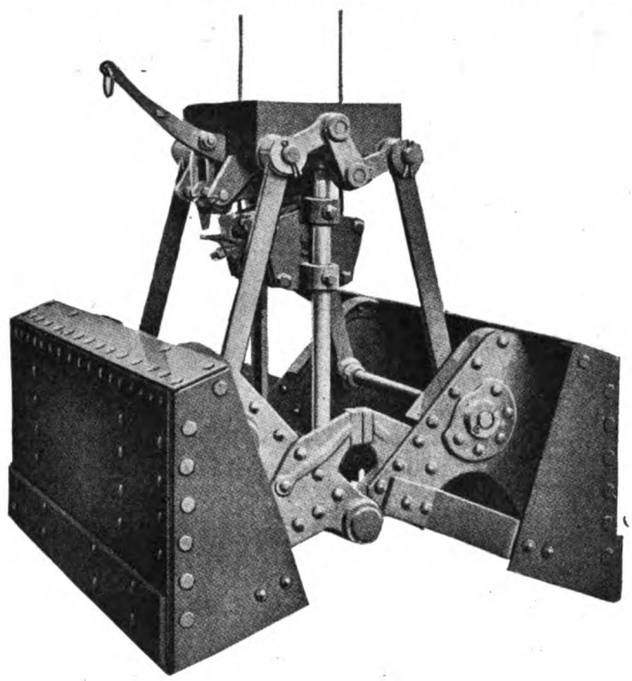
weight together with maintaining equal expansion and contraction of pistons and cylinders, in order to ensure a perfect fit at all temperatures. The pistons are of gray-iron and weigh from 40 to 50% less than stock factory pistons. The reinforcement ribs under the head and down the skirt favor equal expansion, keep the piston round, carry off the heat, and prevent warping, keeping the motor cooler. The pistons can be furnished in any standard size or oversize, either finished or semi-finished.

SINGLE-LINE GRAB-BUCKETS

The P. & H. single-line grab-bucket grew directly out of the needs of foundrymen and the peculiar conditions to be met in foundry practice. A few years ago the management of a prominent steel plant went to the Pawling & Harnischfeger Co. with a problem in handling loose sand in the foundry. The ordinary two-line grab-bucket requires a special and quite complicated hoisting apparatus (with some types of buckets special electric wiring is necessary), and when the crane is so fitted it is practically forced out of other service until the grab-bucket equipment is dismantled. This impractical feature of crane and grab-bucket operation is what the steel-foundry men wanted the company's engineers to eliminate. The solution of the problem was to design and construct the P. & H. single-line grab-bucket embodying the following distinct advantages:

Rugged simplicity of construction to withstand the severe usage of the foundry. There are no winding ropes, electric wiring, motors, or intricate parts in the P. & H. bucket requiring constant attention and frequent replacement. A single line to lower or hoist the P. & H. bucket, thus dispensing with the usual double-drum hoisting and lowering mechanism of two or three-line grab-buckets. The illustration shows two suspension-cables—an apparent contradiction of the single line; these cables operate in unison, however, and give added strength and balance by distributing the strain between them.

Automatic mechanism requiring no special crane-equipment or hoisting-apparatus in order to be put into immediate service. The bucket is simply slipped on the crane-hook.



P. & H. Grab-Bucket

Likewise, when the crane is urgently needed for other service there are no cumbersome ropes to be detached or complicated wiring to disconnect—crane and bucket are run to some conveniently vacant space in the shop, the bucket is dropped, and the crane proceeds on its way to carry other burdens. Shop and foundry men do not need to be told what this means in a saving of time and labor.

P. & H. single-line grab-buckets are built in the Pawling & Harnischfeger Co.'s shops according to the usual standards of the company. They are in use in California by the Union Tool Co., Llewellyn Iron Works, and Hercules Foundries, Inc., of Los Angeles, and the Holt Manufacturing Co. of Stockton.

NORTH AMERICAN BLOW-TORCHES AND BLOWERS

To meet the demand for a small simple device that would produce a high-temperature gas flame at a moment's notice, the North American Manufacturing Co., of Cleveland, has perfected the North American gas-electric blow-torch. The outfit is self-contained, requiring only connection with the electric-light socket and the gas-line to produce an even temperature as high as 2500°F. It can be adjusted instantly to any position or angle, and can be carried anywhere in one hand. Fig. 1 shows the device used in a small hardening furnace, maintaining any desired temperature between 300° and 2500°F. Fig. 2 shows the same torch being used for pre-heating a ladle. Some of the other uses to

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which a torch of this kind may be used include annealing, forging, brazing, babbitting, making shrink-fits, melting metals, heating core-ovens, and straightening and bending metal articles of all kinds. The company also manufactures

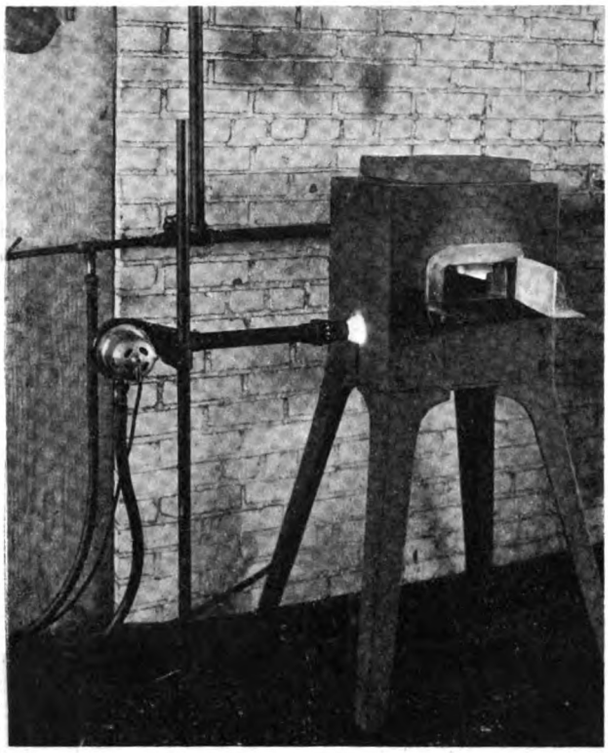

Fig. 1. Blow-Torch Used with Hardening-Furnace

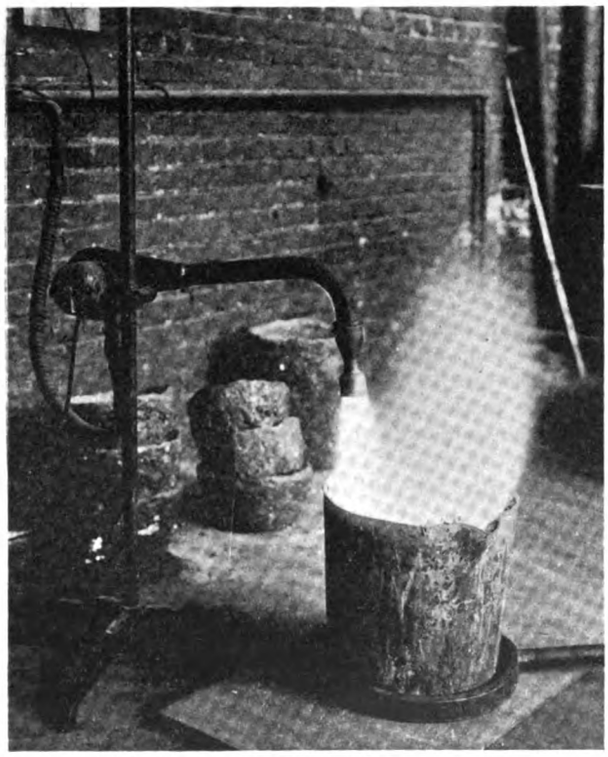

Fig. 2. Blow-Torch Drying a Ladle

an oil-electric torch, which burns kerosene instead of gas.

For work requiring larger heating-units the company has developed the North American gas-electric blower. This is of substantial construction. It will operate continuously for practically any length of time, since over-heating of the motor is prevented by the air entering the blower, which must first pass around the motor before entering the fan-chamber. The gas enters on the opposite side, and the mixture of air and gas is made by a rapidly revolving fan. Both the volume of air entering the blower-housing and the sup-

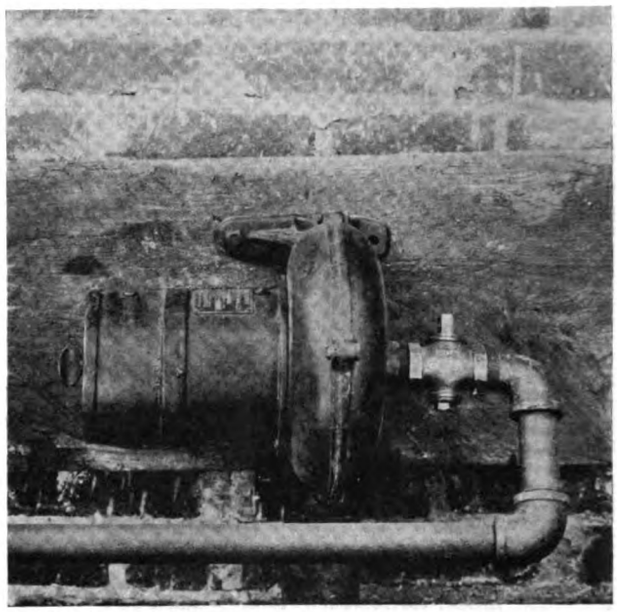

Fig. 3. Blower in Plant of Layne & Bowles Company

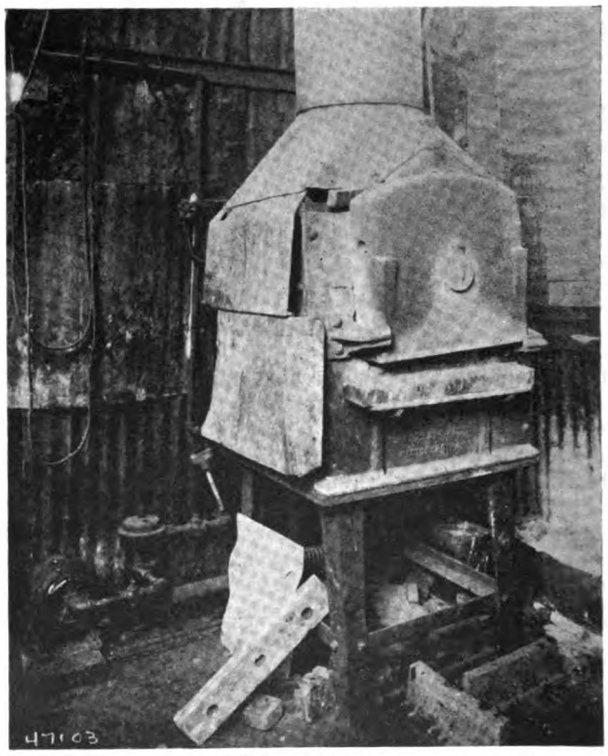

Fig. 4. Blower in Plant of Southern California Iron & Steel Company

ply of gas is under instant control. This blower is particularly adapted for use in hardening, annealing, rivet-heating, forging, and melting furnaces, also core-ovens and japanning ovens. It can be used either as a stationary outfit or can be made semi-portable. Fig. 3 shows a blower of this type in use at the plant of the Layne & Bowler Pump Co. at Los Angeles, and Fig. 4 shows a similar blower at the plant of

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the Southern California Iron & Steel Co. The latter company is using several of these blowers on its furnaces and reports a saving of 55% in cost of fuel over the gas-burners formerly used, and of 50% over oil-burning furnaces. It also states that no difficulty is experienced in maintaining a temperature of 2500°F. with properly constructed furnaces. The North American company is represented in California by Forbes Brothers Co., of Los Angeles.

NEW OIL-IMMERSED SWITCH

Magnetically operated main-line switches on alternating current light and power circuits are at times slow and unreliable in closing when a solenoid and plunger must be depended upon for their operation. If the plunger is slightly out of adjustment, its movement becomes jerky and noisy,

Fig. 1. New C-H Oil-Immersed Magnetic Contactor Operated by a Clapper Type Magnet and Armature, Which Increases Reliability of Operation Over the Solenoid and Plunger Type.

its sealing pull is diminished, and it does not seat properly.

The Cutler-Hammer Mfg. Co., of Milwaukee, has developed a new oil-immersed magnetic contactor, operated by a clapper-type magnet, which makes possible a more rigid mechanical structure and greater reliability in operation than

Fig. 2. Some as Fig. 1, but with Oil-Tank Removed, Showing Contacts and Arcing Shields

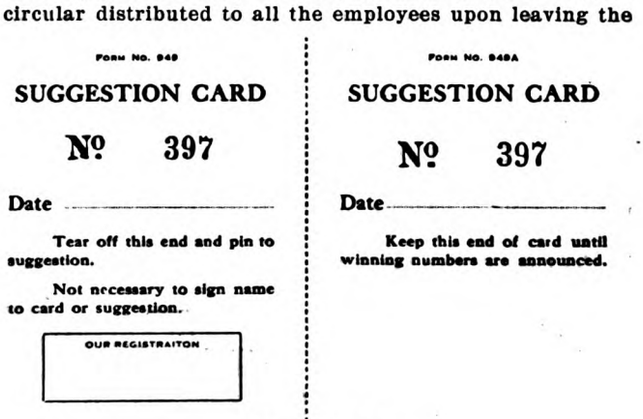
is obtained in contactors of the solenoid and plunger type. This contactor has a capacity of 100 amperes at 2200 volts, and is particularly desirable as a main-line switch for an automatic 2200-volt motor starter, or for the remote control of any 2200-volt light or power circuit. It is built with three poles, unless used with an auto-transformer starter when five poles are provided.

The frame of the contactor, which is of heavy sheet iron, is arranged for wall or switchboard mounting, and carries two cast-iron supports with two insulated shafts carrying the contacts. Copper-leaf brush contacts are saved from all wear due to breaking the circuit because auxiliary arcing contacts are provided for this purpose. Leads from the contacts connect with suitable terminals extending through high-tension insulators mounted on the top of the frame. The armature is firmly pivoted to the frame, and is connected by a rod to an arm of the shaft carrying the moving contacts. The attraction of the armature against the face of the magnet rotates the shaft and closes the switch, which is normally held open by the weight of the moving parts.

A flood head of oil is maintained over the contacts by providing a sheet-metal tank of ample capacity, and as the contacts are situated above the operating shaft, they are away from any sediment which might accumulate in the bottom of the tank. The arc is broken at the contacts in a horizontal direction and therefore rises to the point of rupture without burning other parts. Transite shields prevent arcing across adjacent poles.

HOLT MANUFACTURING COMPANY STARTS SUGGESTION CONTEST AMONG EMPLOYEES

On January 1 a continuous suggestion contest was started by the Holt Manufacturing Co. at its Stockton plant. Each month, five prizes will be awarded of $15, $10, $5, $2.50, and $2.50, respectively. At the end of each year, three grand prizes will be awarded of $50, $20, and $10, respectively. A committee of five passes on the suggestions received. The method of conducting the contest is best described by the following extracts, the first of which is from a circular distributed to all the employees upon leaving the



FORM NO. 848

SUGGESTION CARD

Nº 397

Date .....

Tear off this end and pin to suggestion.

Not necessary to sign name to card or suggestion.

OUR REGISTRAITON

FORM NO. 848A

SUGGESTION CARD

Nº 397

Date .....

Keep this end of card until winning numbers are announced.

Suggestion-Card

shop, and the second is from a notice posted in several places.

"We appreciate the fact that every employee, no matter what his position, may have suggestions regarding his work or concerning the company and its product. We are always pleased to receive such suggestions, and to encourage them will offer, beginning immediately, monthly annual prizes. All suggestions received will be held strictly confidential and no suggestions will be considered too small to receive attention.

"A suggestion-box has been placed near each time-clock. Suggestions can be made out on any kind of paper that may be handy. Suggestion-cards can be found in holder on suggestion-box, fill one of these cards out, pin it to your suggestion and drop it into suggestion-box, or, if you do not care to do this, mail your suggestion direct to Secretary, Suggestion Committee, The Holt Manufacturing Company.

"Prizes will be awarded on the best suggestions that contain merit regardless of whether the suggestions are adopted or not. A committee has been appointed to pass on all suggestions received and will award prizes on the fifteenth of each month. The grand prize awards will be made for the best suggestions received throughout the year.

"Concentrate your thoughts on the following and see what you can do.

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1. Do you know of any waste that can be stopped? Remember every dollar saved helps pay your wages.

2. Can you suggest any improvement in shop equipment, such as tools, jigs, etc.?

3. Do you know of any better ways of machining parts than now used?

4. Can you suggest any improvement in our product?

5. Do you know of any safety devices needed in our plant?

6. Can you improve our methods of handling material in factory?

7. Can you improve our methods of handling orders, work-tags, time-cards, etc., in factory?"

"In order to assure everyone that the awards for suggestions will be made strictly upon the merits of the suggestions submitted, and that no favoritism will be shown, it has been decided to handle suggestions as follows:

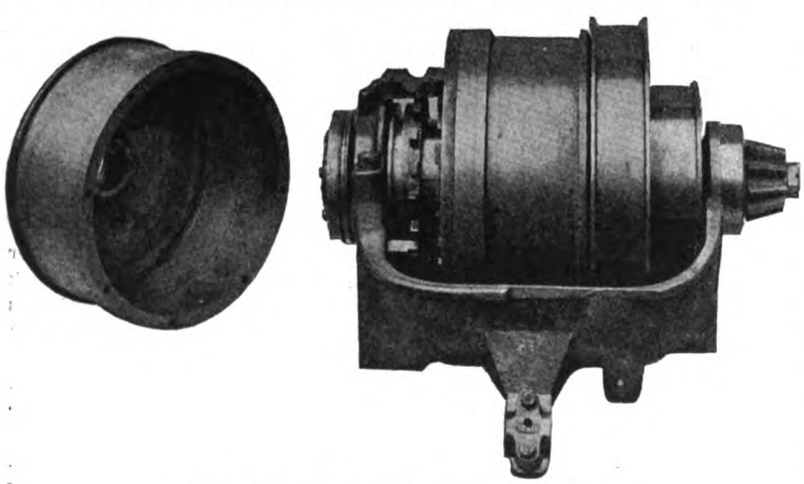
"A double suggestion-card has been provided, each half carrying the same serial number. When submitting a suggestion take one of these cards from the suggestion-box, tear in half along perforation, pin left-hand half to suggestion and keep other half.

"After placing your suggestion in box or mailing it in, it is known from that time on by number only. Do not sign your name as the number on the suggestion will be the same as the number on card that you have kept. In this way your name is not known even to the suggestion committee."

The suggestion committees' files are arranged so that a suggestion is not permitted to die in the files but is referred to the proper parties for investigation and is 'kept moving' until it is either adopted or rejected.

MALLEABLE CASTINGS REPLACE BRONZE IN SPECIALLY DESIGNED TRANSMISSION

Captive observation-balloons, even in the absence of any risk from enemy attack, operate with considerable danger to the occupants, and require instant 'release' and 'recovery' by the mechanician operating the apparatus at the ground-end. Through the courtesy of the American Malleable Castings Association we are permitted to show the part of the equipment where 100% efficiency is required for the protection of the lives of the observers. This is the transmission. It is connected with the windlass through the bevel-pinion meshing in the bevel-gear, which is attached to the winding-drum. This transmission has three brakes, one of which, composed of a steel band lined with copper segments, operates on the surface of the large case or drum. This latter is especially designed not only to function with the brake, but to house the transmission. The gears inside this case, which is shown separately, operate in oil and at such high speed that tremendous pressure is exerted against the sides of the case. The case must not only be entirely free from the slightest flaw and of great tensile strength, but, in order to ensure the efficient operation of the brake, its texture must permit such accurate machining that the escape of the slightest amount of oil is prevented. In the original French design this case was made of bronze, but in this country it was possible to secure a malleable casting meeting all the requirements of the Government's specifications and in some respects proving much superior to any other material. For obvious reasons the identity of the foundry manufacturing these parts cannot be stated, except to say that the maker is a 'ceritfied' member of the American Malleable Castings Association and is licensed to make 'certified malleable castings'. The separate casting after machining weighs 40.5 lb. and has an outside diameter of 12⅝ in. and a wall ½ in. thick. The total depth at the hub is 6½ in., and the outer rim 5 inches.



Malleable-Iron Transmission for Captive Balloons

DURIRON*

Duriron is the American silicon-iron developed within the last eight or ten years particularly on account of its acid-resisting properties. It is coming into use quite extensively as material for acid containers, pipes, condensers, pumps, electrodes, fittings, and all acid-proof apparatus. Thus the use of rare, expensive metals is being gradually eliminated in favor of this silicon-iron.

In appearance duriron is a silver-white close-grained cast-iron. It may be cast into any shape desired. It is extremely hard and cannot be machined. There is a special brand of this silicon-iron, however, that is soft enough to be machined.

This material may contain up to 15% or even more silicon, with usually less than 1% each of carbon, manganese, and phosphorus. The distribution of these constituents directly affects the properties of the alloy and they are manipulated to produce any brand of silicon-iron desired.

It is slightly inferior to cast-iron in density, tensile strength, transverse strength, crushing strength, and heat conductivity. It is harder than cast-iron and very much superior in resistance to corrosion. The comparison in the last case is said to be about 1000 to 1.

Since it is too hard for ordinary machining, the grinding-wheel is naturally used in removing all surplus material from the casting and also for shaping or working the material. Tests have been made to determine the most efficient grain, grade, and kind of wheel. The following is a brief summary of the general results from these tests:

Cylindrical grinding—36-K to N Crystolon vitrified; 46-J to N Crystolon vitrified.

Internal grinding—36-K to O Crystolon vitrified; 46-K to Q Crystolon vitrified.

Surface grinding—36-J Crystolon vitrified.

Off-hand grinding—20-P to Q Crystolon vitrified; 24-P to Q Crystolon vitrified.

The grain and grade of these various operations depend largely on the size of wheel being used, the type of machine, and the surface desired, but the foregoing have proved generally satisfactory. Thus it will be seen that duriron can be ground successfully with the same grains and grades as would be used for cast-iron.

The Columbia Steel Co. will put its new rolling-mills in operation at Pittsburg, California, in time to commence shipments during April.

*From 'Grits and Grinds'.

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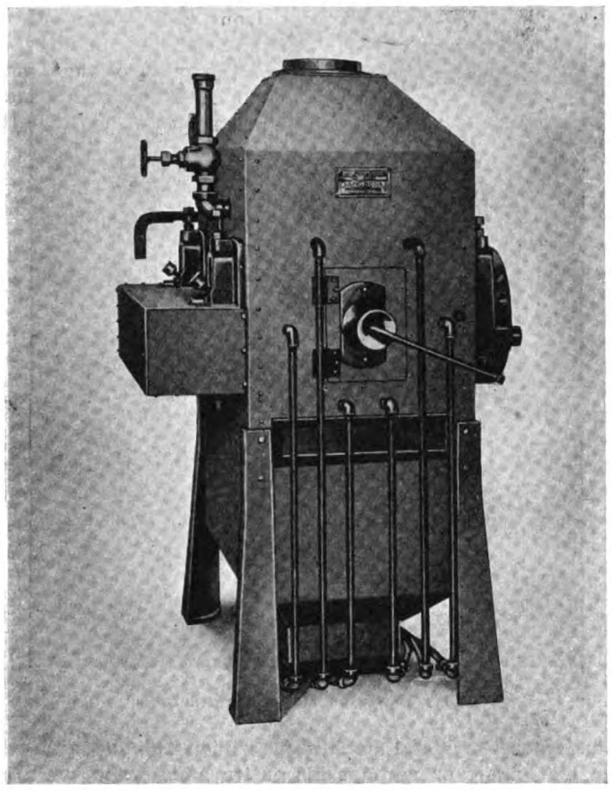
ROD-CLEANING SAND-BLAST CABINET

A new cabinet for the sand-blasting of various shaped rods, from ⅜ in. to ⅞ in. diam., just produced by the Pangborn Corporation, Hagerstown, Maryland, embodies some novel features of continuous operation, with hygienic construction for protection of the operator. The blasting operation being entirely confined, the cabinet can be installed with other machine tools without detriment; this feature also removes the operator from all contact with dust-laden



The Pangborn Rod-Cleaning Cabinet

air. A set of rolls and guides at either end of the cabinet provide constant, uniform travel of the rods through the blasting-zone. The feed-rolls are shaped to handle all diameters from ⅜ in. to ⅞ in. and of varying shapes. By six blast-projectors, centring to the rod at a 45° angle, the blast-stream covers the entire surface of the rod, the discharge being directed toward or into a small chamber that utilizes the rebound effectiveness of the abrasive. Using an air-pressure of 80 lb., scale has been removed from ¾-in. rods at the rate of 50 lin. ft. per minute. The bottom of the cabinet forms a hopper for abrasive storage. The blast-action is of the suction-type. Individual boxes in plain sight of the operator feed each blast-projector. Connection to an exhaust system removes disintegrated material. The cabinet is adaptable for use with either sand or metal abrasives, occupies a floor space only 45 by 51 in., and is 69 in. high.

A FEW CAUSES OF FEED-LINES IN GRINDING*

By C. H. Norton

Although we probably will never succeed in entirely eradicating the spiral or feed-lines of a wheel on commercial cylindrical work, a few reasons why they appear may be of interest.

First, it is impossible to feed a wheel an amount exactly equal to its width for each revolution of the work. It must ride a little. In others words, the screw-pitch, the lead, is a little less than the width of the wheel. What happens? There is a certain part of the work which the wheel goes over twice. Therefore, the little grain-marks look different in that part. You will never eradicate that; the wheel goes over there twice, and those grain-marks will always be a little different looking than the rest of the piece.

Second, if the spindle of the machine is not exactly parallel with the traverse of the table on the ways (if you want to be very careful as in grinding big rolls or anything of that kind), you must place your diamond exactly in the same plane as the axis of the spindle and the work. Then the face of the wheel will be exactly parallel with the traverse. For instance, if your spindle was tipped up, say, 3 or 4 in. and the wheel was trued across the top, you would have a cone. But if you true it with a diamond in the same plane as the two axes of the work and spindle, then the face of the wheel must be parallel with the face of the work and, therefore, that cause for spirals or feed-lines is eliminated.

Third, the diamond in Norton cylindrical grinders is held slightly above the centre for convenience, and we do not always have to take the work out. When truing a reasonably wide wheel with a diamond, of course you want to use a copious supply of water. You do not want the diamond to get red-hot, but if the water does not touch every spot on that wheel, the place where it does not touch will be a different diameter than the rest of the wheel. This will cause feed-lines.

Fourth, if a wheel is used that is too hard, it will separate the axis of the work and wheel slightly, say, 0.00001 in., and as the wheel drags by it will leave a mark. If the axis of that work separates from the wheel, or if you bend the work 0.000001 in., you will see that line in the finished work when it is completed. If you use a soft wheel, this cause of feed-lines will be eliminated. You can grind and make work look beautiful, if you do not want too high a finish.

You must be careful; you must use good steady-rests without springs. You must true the wheel carefully, having every bit of it wet, and you must listen to that wheel as you would to any sound. The sound of the dressing must be uniform clear across the wheel, or feed-lines will be caused.

As a matter of fact, feed-lines do not affect the accuracy of the work. They cannot be measured, and the only difference is in the appearance. If two shafts are lapped, one having feed-lines and one without feed-lines, there is no difference in the finished shaft. The important thing to bear in mind is that feed-lines affect only the looks, the accuracy being unaffected.

*From 'Grits and Grinds'.

THE DEPARTMENT IDEA IN MANUFACTURING

The man who analyzes the organizations of any of our great industries soon comes to an appreciation of the extent to which specialized knowledge has been responsible for their tremendous development. The plant that today is considered of pretentious size has long since outgrown one building. Often it can best be described as a hugh assembly-room, surrounded by separate departments, each contributing its particular product or performing its special function, as a distinct and yet co-ordinated unit of one organization. Not only have these departments of specialized work developed within one plant, but frequently it has been found advisable to distribute the various contributing departments over a wider field, and for various reasons. Sometimes the supply of labor, material, or fuel may require placing a unit many miles from the central plant.

Furthermore, in many instances, so-called departments have in themselves become separate and distinct industries, because men have conceived of possibilities in the adapta-

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bility of a product which could never have been realized where limited opportunity only was afforded. These might be designated today as 'contributing industries' because in a way they are dependent on the parent industry inasmuch as their products are not intended for independent use. In many instances the parent industry or organization has come to depend on these separate industries as its own special departments from which it draws, as need requires, for the assembly of a complete product.

Take the automobile industry for example. Many manufacturers design the chassis, and then turn to these contributing industries for motors, bearings, axles, or wheels. Bodies, tops, and many other parts might be mentioned as frequently coming from outside departments. Perhaps none of these departments or separate industries have won a more pronounced recognition than the pressed-steel industry, whose products fulfill not one particular function but have rapidly developed a wide and ever increasing application wherever steel may be used. The growth of this one-time department to a separate industry is logical, because, essential as pressed-steel parts have become, the elaborate facilities for their production call for an outlay unwarranted in nearly every instance by individual requirements.

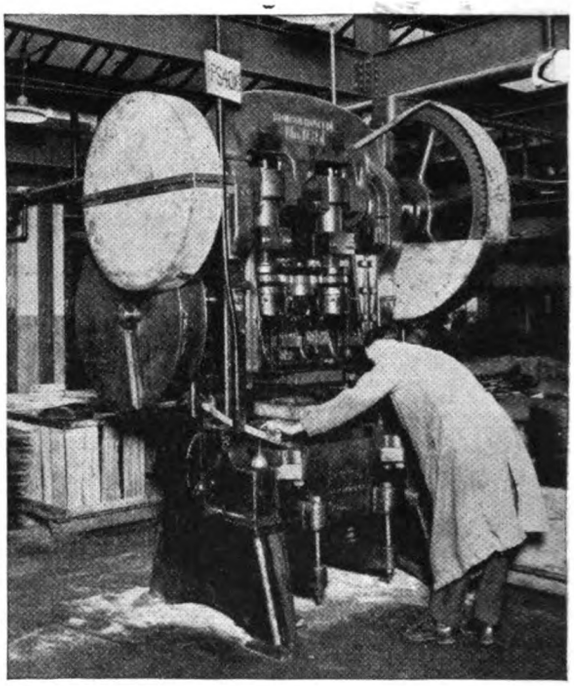
Gear-making, as exemplified by the Van Dorn & Dutton Co. of Cleveland, furnishes an instance of an entirely different industry also devoting its energies as a contributing factor to parent industries. Though organized and widely recognized many years before the automotive industry developed, yet its rapid growth in recent years can be largely attributed to a fuller realization by manufacturers requiring gears, that these may be more satisfactorily and economically secured from a specialized department where mechanical and technical skill, together with every facility is immediately available for any problem in gears that may arise. Again, the manufacture of cut gears calls for an assembly of men and modern equipment not practicable except where great volume, precise execution, and dependable quality are demanded.

Millions are invested by manufacturers of bearings, springs, axles, wheels, and other parts, to say nothing of tires, all contributing industries to the single parent industry of automotive manufacture. The growth of these specialized industries has come because their existence and operation fit into the economic scheme of production. If this were not so, great organizations with available capital would cease to draw their supplies from these outside departments. Not only from the economic standpoint but because this arrangement distributes responsibility and opportunity and thereby stimulates initiative is it desirable as a condition. Let us consider the problem that would confront the man with an idea if these specialized department industries were owned or controlled by the parent industries to whose finished product their output contributes. How much capital would it require for the new company to provide even a modest equipment for a limited production? Since this is so, is it surprising that established and prosperous concerns in increasing number are turning to these departments already in operation rather than risk the investment required properly to equip and maintain their own?

The National Axle Corporation has been organized to manufacture axles for motor trucks. A site comprising 12 acres has been secured at San Jose, and work on the factory will be commenced soon, including the erection of a malleable-iron foundry. The corporation will make a specialty of axles for worm-drive trucks. The officers of the company are: J. G. Travares, president; S. C. Kyle, vice-president and general manager; N. Elliott, purchasing agent; A. H. McCleary, metallurgist; and J. L. Armstrong, superintendent. Until the San Jose plant is completed, offices will be maintained in the Rialto building, San Francisco.

AN EFFECTIVE SAFETY-DEVICE USED ON MACHINES; ALSO MAKING A SAFETY-DEVICE

The accompanying illustration shows a motor-operated side-press in the machine-shop of the Square D Co., of Detroit, which is provided with an effective safety-device for protecting the hands of the operator. The press is actuated by a tread or lever, which throws the clutch. Without the safety-device, the operator while operating the press with his right hand, might unconsciously fail to remove his left



Safety Device on Motor-Operated Press

hand from the metal he has placed on the die and thus lose his fingers or perhaps his entire hand when the press closes. To prevent this a lever is provided also for the left hand. This is connected in the rear of the press to the right-hand lever by means of a rod. Both levers must be held down at one time in order to throw the clutch. To press only one merely raises the opposite lever and allows the clutch to slip. The operator is compelled to keep both hands out of danger in order to operate the press. This side-press stamps, presses, perforates, and fashions sheet-steel into boxes that are used to enclose the live parts of electric switches, forming a protective device for household and industrial users of electric current. The switch is also shown in the illustration.

VIXEN FILES

Although the Vixen fast-cutting file has been used on the coast for a number of years, its advantages are not nearly as well known here as in the East. The curved teeth of the Vixen file furnish the principal reason for its superior cutting capacity. These teeth act upon the metal with a shearing effect. They produce automatically the diagonal motion which is the most effective for any cutting tool from a razor to a saw. The curve has another advantage, incidental but none the less important to the working efficiency of the file. This is its success in shedding filings, however greasy the material, keeping the teeth clean and avoiding the frequent delays involved in the clogging of ordinary files. The Vixen differs from the ordinary file in that the teeth are milled instead of being hammered or struck-up. As a result the cutting speed is much greater, in fact, it is sold under a guaranty to cut three times as fast as the ordinary file. During

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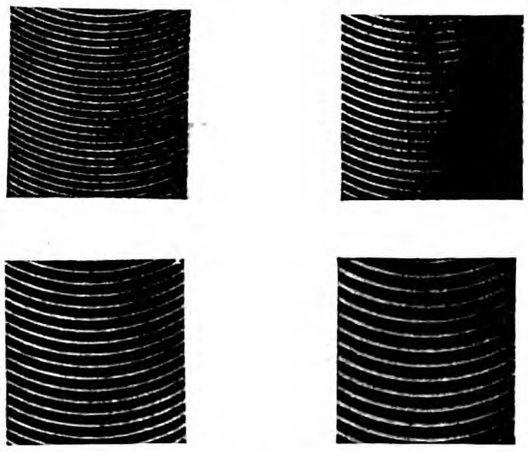
the War the Government requested ammunition workers to use the Vixen file in order to speed production. The Fischer Body Works of Detroit have 7000 Vixen files in operation. Some of the men using these worked on piece work and during a period when Vixen files could not be obtained went on



Dead-Smooth, Smooth, Fine, and Regular Grades of Files

strike because they could only produce one-half the work with the ordinary file. A number of the shipyards and gas-engine manufacturers in California have adopted the Vixen recently because of its fast-cutting qualities. It is being handled on the Pacific Coast by the Coast Vixen Co., of which the Charles A. Dowd Sales Co., 320 Market street, is the representative.

Book Reviews

The ABC of Iron and Steel. Edited by A. O. Backert. Third edition. Pp. 363, ill., index. The Penton Publishing Co., Cleveland, Ohio. For sale by 'Mining and Scientific Press'. Price, $5.

This is the best single book that we have seen covering the general features of the iron and steel industry. The principal part comprises 23 chapters, each discussing some particular branch or aspect of the industry and each written by an expert in that particular line. Thus the mining and transportation of iron ore, the manufacture of coke, and the manufacture of iron, steel, and the principal steel products, together with the processes used are all discussed in order. The text is accompanied by many illustrations, both photographs and diagrams. Appendixes contain statistics of the industry and a directory of iron and steel works in the United States and Canada, arranged both alphabetically and according to products. The principal changes made in the third edition as compared with the second, include bringing these appendixes up to date, the insertion of an entirely new chapter on malleable castings, and a great deal of new matter to the treatment of the rolling-mill industry. While the various chapters are so complete as to contain much new information for the expert, they are so clearly written as to form fascinating reading for the layman.

Millions From Waste. By Frederick A. Talbot. Pp. 308. J. B. Lippincott Co., Philadelphia. For sale by 'Mining and Scientific Press'. Price, $5.

As a result of the War, the scrap-heap has come into its own. In fact, the expression 'thrown upon the scrap-heap' no longer has its old significance, since all it probably indicates is that the article in question has simply been placed in a convenient place for storage until it can be worked over into some other useful form. The present volume deals with the reclamation of waste of all kinds, from scrap-iron to fish-offal. Although it is written from the British standpoint, the solutions that are given of the various problems are as applicable to American conditions. In general, each chapter considers some particular kind of waste product, discussing both the extent of such waste and the processes that have been developed for utilizing these products. Wastes from the kitchen, the slaughter-house, the fishing industry, the ash-can, the sewer, the metal industry, and many other branches are discussed. The treatment is popular enough to be interesting, but not so popular as to fail of being informative.

Complete Practical Machinist. By Joshua Rose. Twentieth edition. Pp. 536, ill., index. Henry Carey Baird & Co., Inc., New York. For sale by 'Mining and Scientific Press'. Price, $3.

It is 26 years since the first edition of this useful book appeared. The work has been considerably revised and enlarged for the new edition, and while the earlier editions were devoted almost entirely to the cutting-tools themselves, the present volume also discusses at considerable length the machine-tools in which the cutting-tools are used. The book is written for the practical machinist without technical education, but many technically trained engineers could also find it useful. The chapter-headings are as follows: Cutting Tools for Lathes and Planers; Cutting Speed and Feed; Boring Tools for Lathe Work; Screw-Cutting Tools; Lathe-Dogs; Turning Eccentrics; Hand-Turning; Drilling With the Lathe; Boring-Bars; Slotting-Tools; Twist-Drills; Tool-Steel; Taps and Dies; Vise-Work; Fitting Connecting-Rods; Milling-Machines; Tool Grinding; Marking Out Work; Machine-Tools; Precision-Lathe Attachments; Gear-Shapers; and Miscellaneous Attachments. There are also three short chapters at the end of the volume on calculation of the speed of wheels, etc., on setting slide-valves; and on repairing pumps. We are inclined to believe, if the book were entirely re-written, that more space would be devoted to such subjects as high-speed steel, grinding-machinery, and other relatively new developments in the industry. However, although perhaps not very well balanced, the book is a useful one.

The Strategy of Minerals. Edited by George Otis Smith, Director of U. S. Geological Survey. Pp. 360, maps and tables. D. Appleton & Co., New York. For sale by 'Mining and Scientific Press'. Price, $2.

This book gives emphatic point to the proposition of our national dependence upon mineral resources. This is one more of the lessons brought home to us by the War, and the thirteen chapters, by as many government officials, point out, first, the unusual requirements brought about by the War, second, the way in which these requirements were met, and third, the necessity for maintaining efficient production, with a constant recognition of the need for conservation, now that the War is over. The vital importance of mineral supply is illustrated by Germany's ability to continue the War as long as she did, solely by virtue of her possession of the minette iron deposits. There are brief surveys of our resources in fuels, iron, copper, lead, zinc, and miscellaneous minor minerals, with some general information of a statistical character. That we are far more abundantly endowed with mineral wealth than any other country is demonstrated, and in the final chapter the editor points out the need for exceptional foresight and sagacity in organizing industry in this country. He has faith in "the scientific efficiency of the American engineer, the highly productive capacity of American labor, and the far seeing conservatism of American democracy". The book commends itself to readers of forward vision.

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Trade Notes

The Llewellyn Iron Works, Los Angeles, will build a one-story shop addition.

The Stockton Canning & Packing Co. will construct a $65,000 cannery building.

The California Packing Corporation will spend $10,000 in remodeling its plant at Sacramento.

The Moeller Auto Sales & Service Co., Sacramento, is building a $100,000 building at Twelfth and K streets.

W. J. Rush has purchased the Kent blacksmith-shop at Delano, California, and will add a cabinet-making shop.

The Gill Piston Ring & Sales Co., Los Angeles, has been organized by Charles W. Monahan, Jr., to manufacture piston-rings.

William Walsh will start a foundry at 165 South Rio street, Los Angeles, to be known as the **New Process Foundry Company.**

The Aurora Welding & Machine Works has moved into its new quarters in the George Co. building, 37 South Aurora street, Stockton.

The Oregon Brass Works, Portland, is installing two new electric steel-furnaces and a quantity of other equipment to cost approximately $20,000.

The International Iron & Steel Co., Los Angeles, has been incorporated with a capital of $200,000 by W. G. Harris, A. B. Linard, and W. H. Durst.

The United States Fibre Products Co. has completed its $300,000 plant at Sacramento. The company manufactures insulating material from straw.

The Empire Foundry & Machine Works of Marysville has made additions to its plant and is now ready to handle all kinds of foundry and machine work.

L. S. White has been appointed the Los Angeles representative of the **Pawling & Harnischfeger Co.** of Milwaukee, with offices at 1125 Central building.

Bids will be received until March 22 at the **U. S. Engineer Office**, San Francisco, for dredging about 6,000,000 cu. yd. of material on the lower Sacramento river.

The San Joaquin Light & Power Corporation will build a steam-electric plant near Taft. Natural gas will be used for fuel. The estimated cost is $1,000,000.

Contract for construction of two 2350-ton steel coasting steamers for the **Coastwise Steamship & Barge Co.** has been awarded to J. F. Duthie & Co., of Seattle.

Contract for the reconstruction of the Yosemite theatre at Stockton has been awarded to **Macdonald & Kahn**, of San Francisco. The estimated cost is $140,000.

Work has been begun on an addition to the Visalia garage, Visalia. The additional space will be utilized for a display of trucks, tractors, and a new line of heavy machinery.

The Pacific Rolling Mill Co. has been awarded a contract for furnishing steel for a one-story steel-and-brick machine-shop to be erected for Kleiber & Co., at Folsom and Juniper streets.

A fire, believed to have been started from a short circuit in the electrical shop, destroyed four buildings of the **Redwood Manufacturing Co.**, at Pittsburg. Loss estimated at $50,000.

The Nevada County Narrow Gauge Railroad is preparing plans for a 28-mile extension to a point near Camptonville, California, tapping a timber-producing district in that vicinity.

O. L. Starr, factory manager for the **C. L. Best Gas Tractor Co.**, is making a tour of Eastern machine-tool and other manufacturing plants investigating the latest improvements in tools and special production machines. He will return about March 20.

The Tool Equipment Co., agents for California for the **Geometric Tool Co.**, has moved its offices from 735 Folsom street to 112 Market street, San Francisco. Henry Jurs is manager.

The United States Compression Inner Tube Co., of Tulsa, Oklahoma, will construct a factory for making automobile tires and casings at Los Angeles. The estimated cost is $1,000,000.

The Pacific Coast Shipbuilding Co. has laid keels at its Bay Point yard for two tank-steamers, one 125 ft. and the other 200 ft. long, which are being built for the **Associated Oil Company.**

The Los Angeles Harbor Commission will sell $500,000 worth of bonds soon. The proceeds will be used for various harbor projects. This $500,000 is part of a $4,500,000 issue recently authorized.

C. A. Hennense of Vallejo and W. J. Hensen of San Jose, representing capitalists who intend to engage in the manufacture of tractors, have taken a sixty-day option on the Liberty Iron Works of Sacramento.

The Columbia Manufacturing Co., of Belleville, Illinois, has issued its Grinder Book No. 26, covering grinders and buffers, and countershafts and presses for the heavy hardware, mill-supply, and automotive trade.

The Hauck Manufacturing Co., of Brooklyn, New York, has issued Bulletin No. 119, describing the many types of oil-burners manufactured by the company, and explaining the work for which each one is specially suited.

Schaad Brothers, of Willows, California, have bought the machinery of the Biggs Co-operative Rice Mill at Biggs. The equipment cost $50,000 when new. It will be installed in a rice-mill to be erected either at Willows or Williams.

There is a strong demand for mining and milling machinery for use in the Orient. The **Joshua Hendy Iron Works** is making large shipments especially to the Dutch East Indies, and also to Japan, Korea, and South America.

J. Otis Burrage, who has been with the Emergency Fleet Corporation for the past two years in various capacities, has been appointed district engineer in charge of the adjustment of cancelled ship-contracts for the Southern Pacific district.

A. W. Ransome has been appointed Western sales manager for the **Blaw-Knox Co.**, with headquarters in the Monadnock building. **Irving Burrows**, who formerly had charge of this office, has gone to France for the same company.

The Aluminum Castings Co. has changed its name to **Aluminum Manufactures, Inc.** The main office of the company is at Cleveland, and the factories are at Cleveland, Detroit, Buffalo, Fairfield, Connecticut, and Garwood, New Jersey.

E. D. Monroe, construction engineer, stated just before sailing for India recently that British and American capitalists have organized a company to erect two steel plants, one at Bombay and the other at Calcutta, which will cost $30,000,000.

The Twin Harbor Tool Co., of Long Beach, has been incorporated with a capital of $100,000 by I. A. Church, Ray Meacham, and James Pauson, all of Long Beach. The company will manufacture tools, machine-parts, and other equipment.

The California Tractors Co., Inc., has been organized with a capitalization of $500,000 to construct the 'Bearcat' tractor, which is really a tracklayer type attachment that can be used with an automobile-engine, the wheels, etc., of the automobile being removed. The officers of the company are John W. Galway, president; A. R. Hathway, vice-presi-

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dent and manager; A. R. Udall, secretary and treasurer; D. S. Matthews and C. L. Hatch, directors.

The firm of **Wirth & Buckles**, operating a machine-shop at The Dalles, Oregon, has dissolved partnership. E. J. McMahon has bought Mr. Buckles' interest and a new company has been formed under the name of the **Columbia Highway Machine Company.**

Strauss & Buegeleisen, of New York, the originators and manufacturers of Resistal non-shatterable glass for industrial-works goggles and plate-glass for grinding-wheels, have opened an office at 507 Mission street to take care of their increasing Pacific Coast business.

The Westinghouse Electric & Manufacturing Co. has issued circular No. 7176 'Application of Electricity to the Metallurgical and Chemical Industries'. Besides describing some of the company's apparatus, the circular contains much interesting technical information.

The California State Railroad Commission has granted permission to the **California Southern Railroad Co.** to issue $135,000 in bonds and $50,000 in stock to provide funds to extend its main line 7.1 miles southerly from the present terminus at Blythe in Riverside county.

A. J. Hubert, formerly superintendent of the machine-shop department at the Holt Manufacturing Co. plant at Stockton, has been appointed general superintendent of the entire plant. D. B. Ellsworth succeeds Mr. Hubert as superintendent of the machine-shop.

In lieu of ten contracts for various steel vessels, which were cancelled at the time when general cancellation of contracts was in progress, the Emergency Fleet Corporation has awarded contracts to the **Northwest Steel Co.** of Portland for the construction of ten steel tank-steamers.

Dredging has been commenced by the **Moore Shipbuilding Co.** for a 10,000-ton floating drydock and two marine railways at its yard on the Oakland estuary. The dock will be 125 by 750 ft. and the site is being dredged to a depth of 45 ft. The railways will have a capacity of 6800 tons each.

The Honolulu Iron Works has bought a half-interest of the Earnshaw Shipway & Engineering Co. The two companies will soon be united in a single corporation, which is to be capitalized at 10,000,000 pesos, and which will engage in marine engineering and in the manufacture of sugar machinery.

Bond issues amounting to $6,000,000 in all have been voted in the Modesto and Turlock irrigation districts for the construction of the Dom Pedro project. The work will include the construction of a large concrete dam, a hydro-electric plant, and several miles of irrigation and drainage canals.

The Electric Furnace Co., of Alliance, Ohio, has issued Booklet 8-B giving photographs and data regarding some important installations of Baily electric furnaces for melting non-ferrous metals. At the time of compiling the booklet the total number of furnaces of this type in actual operation was 61.

Plans are being prepared for the new Matson building to be erected on the south-west corner of Market and Main streets for the accommodation of several firms interested in the Hawaiian trade. It is expected that the building will be not less than 15 stories high and will require 2000 tons of structural steel.

The Niles-Bement-Pond Co. has issued a handsomely illustrated 90-page catalogue describing the electric traveling-cranes and hoists manufactured by the company. The catalogue shows not only drawings and photographs of the principal details but also of a number of installations of Niles cranes. Some space is also devoted to Niles hand-cranes. The San Francisco office of the company is at 16 Fremont street.

A syndicate allied with the **Los Angeles-Pacific Navigation Co.** was the high bidder for the turbine passenger-ships 'Harvard' and 'Yale', recently released from the transport service. It is expected that they will be put on the old run between Los Angeles and San Francisco, in which service they were before the War.

The Monarch Shipbuilding Co. of Portland has been organized by W. Z. Haskins and John J. Reynolds. The company will build wooden ships at the old yard of the Grant Smith-Porter company, the first work attempted being the completion of three wooden hulls purchased from the Emergency Fleet Corporation.

The Ames Shipbuilding & Drydock Co. launched the 25th and last ship, the 'West Jappa', under its contract with the Emergency Fleet Corporation, on February 19. This is the only vessel now under construction at the company's yard, and upon her completion, which will be about March 10, the yard will be closed for a time at least.

"In consequence of the great assistance rendered by the **Holt Manufacturing Co.** to the British government during the War" the British War Office has presented to the company a British Mark IV tank. The machine weighs 27 tons and is 37 ft. long over all and 8 ft. high. It was one of the tanks that figured in the battle of Cambrai.

Volume I, Number I, of 'The Electric Furnace', has recently been issued by the **Electric Furnace Co.**, of Alliance, Ohio. While primarily devoted to the company's product, the Baily furnace, the publication contains several general technical articles and editorials dealing mainly with the electric-furnace industry. It is to appear monthly.

The Inland Auto Thresher & Machinery Co., of Post Falls, Idaho, has bought the plant of the Brown-Lewis Co. of Walla Walla and expects to manufacture 1000 machines during the coming year. The company is now building threshing machines of various sizes. C. N. Galland is president of the company and C. H. Krause is superintendent of the plant.

Pratt & Whitney Co. has issued a profusely illustrated catalogue describing the precision machine-tools manufactured by the company, including lathes and attachments, screw-machines, milling machines, multiple-spindle drills, grinders, shapers, and special machines for making small arms. The San Francisco office of the company is at 16 Fremont street.

The Niles-Bement-Pond Co. has issued a catalogue of machine-tools, a binder containing the various separate circulars issued by the company describing its products, including lathes, planers, drilling machines, shapers, milling machines, shapers, slotters, boring mills, steam-hammers, car-wheel presses, and bending-rolls. The San Francisco office of the company is at 16 Fremont street.

The San Francisco office of the **Smith-Booth-Usher Co.** will be moved about March 15 from 40 Fremont street, to the two-story building now occupied by the United States Rubber Co. at 50 Fremont street. The new building will give the company 40,000 sq. ft. of floor space. A large stock of machine-tools and contractors' machinery will be carried. H. A. Olds is manager of the San Francisco office.

The Acme Gas Engine Co. has resumed work at its plant at 11 Minna street, its men having agreed to return to work at the old scale with the understanding that, if they show they are worth more, the increase demanded before the strike occurred will be paid them. The company has acquired the building adjoining its plant, which was formerly occupied by the Fire Protection & Equipment Co., now consolidated with the Pacific Fire Extinguisher Co. This adds about one-fourth to the Acme company's floor-space. Some

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new machinery has been installed and the shop rearranged for the better handling of the work.

Manning, Maxwell & Moore will move their offices to 40 Fremont street, San Francisco, about March 15. A large stock of tools will be carried at the store-room and at the firm's warehouse. Fifteen carloads of machinery are now on the way. The firm's line includes machine-tools, railway-tools, plate-shop machinery, sheet-metal tools, and wood-working machinery. San Francisco will be the distributing point for the Western States. C. H. Overcamp is Pacific Coast manager.

The Holt Manufacturing Co. has arranged with the Metropolitan Life Insurance Co. to write group insurance for all employees at its Stockton plant that have been employed for two months or more. An employee that has been with the company less than one year receives a policy for $500; one that served from one to five years, a $750 policy; one that has served from five to ten years, a $1000 policy; while those serving ten years or more receive $1500 policies. The total amount of the policies written is approximately $1,250,000, the company paying all the premiums, and each policy remaining in force as long as the employee continues in the service of the company. It is interesting to note, as indicating the low labor turnover of the company, that 102 policies for $1500 were written, 106 for $1000, 750 for $750, and only 600 for $500.

The Westinghouse Electric & Manufacturing Co. has announced a number of promotions among its officials at East Pittsburgh. Among the more important of these are the following: Alexander Taylor, for many years manager of works, has been made assistant to the vice-president, in general charge in all plants of production, stocks, and stores. R. L. Wilson has been promoted from position of general superintendent to works manager of the East Pittsburgh plant. E. R. Norris has been appointed director of works-equipment, in charge of machinery, tools, and methods at the various plants. C. B. Auel has been made manager of the employees service department. G. M. Eaton has been made chief mechanical engineer for the company. C. W. Johnson and H. W. Cope, assistant directors of engineering. C. H. Champlain and E. S. McClelland, assistant works managers. John E. Bonham, assistant to works manager. E. S. Brandt, supervisor of equipment and methods. The following were appointed as managers of the engineering departments indicated: A. M. Dudley, automobile equipment; R. P. Jackson, material and process; F. E. Wynne, railway equipment; and G. H. Garcelon, small motors.

The course in 'Labor Maintenance' or employment management being given by the **Pacific Coast Bureau of Employment Research** under the general direction of **Roy W. Kelly**, opened February 18 with about 30 representatives of Bay district business houses and factories in attendance. Most of those taking the course are actually engaged in personnel work at the present time. In all there will be 40 meetings for lectures and discussion of practical problems, supplemented by visits to plants in the Bay district. The meetings are held Wednesday evenings and Saturday afternoons in Room 457 of the San Francisco city hall. At the first meeting George C. Boardman, vice-president of the San Francisco Chamber of Commerce, discussed the need of industry for trained employment managers to promote proper understanding of employment relationship and to prevent industrial disputes through scientific personnel management. At the second meeting, W. H. Nanry, of the San Francisco Bureau of Governmental Research, spoke on the importance of organization charts to business executives and the cardinal principles of chart-making.

The Foundry Equipment Manufacturers' Association, organized about a year ago to promote and further the interests of its members by impressing upon foundrymen generally the advantages to be derived by the use of efficient foundry equipment, proposes now to broaden the scope of its activities by conducting a campaign of education on the proper care, maintenance, and operation of such equipment after it has been installed. The members of the Association, with their comprehensive knowledge and expericence of conditions and problems in all classes of foundries, have been in a particularly favorable position to accumulate facts and data on the subject. They now propose to embody this information in a series of monthly bulletins, to be issued during the coming year. These bulletins will be sent direct to the executives, superintendents, and foremen of all the foundries in the United States and Canada. That they may receive the attention of the men interested they will be mailed to their home addresses. An adjustable stiff-cardboard cover will be sent with the first of the series so that the bulletins may be filed as they are received and thus be available for reference. The cover will be of convenient pocket size. Only one individual phase of the problem connected with each piece of foundry equipment will be considered in each of these bulletins. It is stated that they will be written in a concise practical manner and will contain a wealth of pertinent hints on the most efficient method of caring for and operating mechanical equipment to secure maximum production and service. The members of the Association are as follows: American Clay Machinery Co., Bucyrus; American Foundry Equipment Co., New York; American Molding Machine Co., Terre Haute, Indiana; Arcade Mfg. Co., Freeport, Illinois; Berkshire Mfg. Co., Cleveland; Beryk Co., Cleveland; Blystone Manufacturing Co., Cambridge Springs, Pennsylvania; Buch Foundry Equipment Co., York, Pennsylvania; Cleveland-Osborn Manufacturing Co., Cleveland; Federal Foundry Supply Co., Cleveland; Foundry Equipment Co., Cleveland; Grimes Molding Machine Co., Detroit; Hanna Engineering Works, Chicago; H. M. Lane Co., Detroit; McLain-Carter Furnace Co., Milwaukee; National Engineering Co., Chicago; S. Obermayer Co., Chicago; Pangborn Corporation, Hagerstown, Maryland; J. W. Paxson, Philadelphia, Pennsylvania; Henry E. Pridmore Co., Chicago; P. H. & F. M. Roots Co., Connersville, Indiana; U. S. Molding Machine Co., Cleveland; Wadsworth Core Machine & Equipment Co., Akron; Whiting Foundry Equipment Co., Harvey, Illinois; E. J. Woodison Co., Detroit; Young Bros. Co., Detroit.

Market Review

Although the strike has long since past, and lack of labor has little if any influence on production, the scarcity of iron and steel continue. Coal and coke shortages interfere with production at furnaces and mills, while car shortage makes deliveries difficult if not impossible. Pig-iron has advanced around $43 and $44, billets are now quoted at $65 and sheet bars $70.

Locally, although the price of pig-iron is still rising, an encouraging feature is the fact that some iron is actually being offered for sale, being the first time in several months that this has happened. There is a runaway market on ferro-manganese with consumers paying almost any price asked in order to obtain deliveries. The warehouse price on steel is $5 base. Deliveries are still so poor that the mill base of $4.50 has little significance.

Local prices of non-ferrous metals are as follows:

Electrolytic copper	19.50
No. 1 red ingot brass	18.50
No. 1 yellow ingot brass	14.50
Electrolytic zinc	11.00
Lead, carloads	9.25
Tin, spot	65.00
Tin, futures	62.50

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